NOAA Fisheries Endangered Species Act (ESA) Section 7 Consultation
Magnuson-Stevens Act Essential Fish Habitat Consultation
Biological Opinion

Action Agencies: The National Marine Fisheries Service (NOAA Fisheries)
The U.S. Geological Survey (USGS)
The U.S. Fish and Wildlife Service (USFWS)
Bonneville Power Administration (BPA)

Species/ESUs Affected: Endangered SnR sockeye salmon (*Oncorhynchus nerka)*
Threatened Snake River (SnR) steelhead (*O. mykiss*)
Threatened SnR spring/summer chinook salmon (*O. tshawytscha)*
Threatened SnR fall chinook salmon (*O. tshawytscha)*

Activities Considered:
1. Issuance of Modification 1 to Permit 1291 to the USGS
2. Issuance of Modification 1 to Permit 1322 to the NOAA Fisheries Northwest Fisheries Science Center
3. Issuance of Permit No. 1362 to the Idaho Cooperative Fish and Wildlife Research Unit
4. Issuance of Permit No. 1363 to the Fish Passage Center
5. Issuance of Permit No. 1364 to the USFWS
6. Issuance of Permit 1366 to the Oregon Cooperative Fish and Wildlife Research Unit
7. Issuance of Permit No. 1370 to the Utah State University
8. Issuance of Permit No. 1386 to the Washington Department of Ecology

Conducted By: NOAA Fisheries, NW Region, Protected Resources Division

Consultation Number: F/NWR/2002/00927

Signature: for D. Robert Lohn **Date Issued:** August 13, 2002

Expiration Date: December 31, 2006

This biological opinion constitutes NOAA Fisheries' review of Endangered Species Act (ESA) section 10(a)(1)(A) permit actions, including six applications for new permits and two requests for modifications to permits that are currently active. It has been prepared in accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). It is based on information provided in the applications for the proposed permits and permit modifications, published and unpublished scientific information on the biology and ecology of endangered and threatened salmon and steelhead in the action area, and other sources of information. A complete administrative record for this opinion is on file with the Protected Resources Division, NOAA Fisheries, in Portland, Oregon.

CONSULTATION HISTORY

Consultations under section 7 of the ESA on the issuance of section 10(a)(1)(A) permits for takes of endangered Snake River (SnR) sockeye salmon, threatened SnR spring/summer chinook salmon, and threatened SnR fall chinook salmon for the purpose of scientific research were previously issued on March 15, 1993; April 13, 1993; June 9, 1993; June 24, 1993; March 4, 1994; April 7, 1995; March 28, 1996, and February 19, 2002 (NMFS 2002). The February 19, 2002 consultation included assessment of take of threatened SnR steelhead and is a five-year consultation which will expire on December 31, 2006.

The proposed actions in this consultation are to issue the proposed new permits and proposed permit modifications and thereby authorize annual takes of endangered SnR sockeye salmon, naturally-produced and artificially-propagated, threatened SnR spring/summer chinook salmon, threatened SnR fall chinook salmon, and threatened SnR steelhead for scientific research and/or enhancement purposes. The NWR's Protected Resources Division decided to group these actions in a single consultation pursuant to 50 CFR 402.14(c) because they are similar in nature, they involve takes of ESA-listed species found within common or overlapping geographic boundaries, and they affect those species simultaneously. The specific purpose of this consultation is to update active consultations that address the issuance of ESA section 10(a)(1)(A) permits for annual takes of ESA-listed Snake River salmonids for the purpose of scientific research. This consultation supersedes the previous consultations (if applicable) and is proposed to be valid for approximately a five-year period ending on December 31, 2006.

Some of the proposed research activities may affect ESA-listed species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) (e.g., threatened bull trout (*Salvelinus confluentus*)). Permit applicants are required to obtain a take authorization from the USFWS if ESA-listed species under its jurisdiction are expected to be encountered.

The consultation histories for each of the proposed permit actions are described below:

<u>Permit Modifications/Amendments</u>

Permit 1291, Modification 1- Columbia River Research Laboratory, U.S. Geological Survey.

The consultation period for the USGS proposed modification to scientific research Permit 1291 began when NOAA Fisheries published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on June 25, 2002.

Permit 1322, Modification 1 -Northwest Fisheries Science Center, NOAA Fisheries.
The consultation period for Modification 1 to the NWFSC's proposed scientific research Permit 1322 began when NOAA Fisheries published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on June 25, 2002.

New Permits

Permit 1362-The Idaho Cooperative Fish and Wildlife Research Unit
The consultation period for the ICFWRU proposed scientific research Permit 1362 began when NOAA Fisheries published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on April 12, 2002.

Permit 1363-The Fish Passage Center
The consultation period for the FPC proposed scientific research Permit 1363 began when NOAA Fisheries published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on April 12, 2002.

Permit 1364-The Idaho Fishery Resource Office of the U.S. Fish and Wildlife Service
The consultation period for the Idaho Fishery Resource Office of the USFWS proposed scientific research Permit 1364 began when NOAA Fisheries published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on April 12, 2002.

Permit 1366-The Oregon Cooperative Fish and Wildlife Research Unit
The consultation period for the OCFWRU proposed scientific research Permit 1366 began when NOAA Fisheries published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on April 12, 2002.

Permit 1370-Utah State University
The consultation period for USU proposed scientific research Permit 1370 began when NOAA Fisheries published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on April 12, 2002.

Permit 1386-The Washington Department of Ecology
The consultation period for the WDOE proposed scientific research Permit 1386 began when NOAA Fisheries published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on April 12, 2002.

DESCRIPTION OF THE PROPOSED ACTIONS

Common Elements among the Proposed Actions
Some of the activities identified in the proposed permit actions will be funded by several Federal agencies including NOAA Fisheries, Bonneville Power Administration, U.S. Army Corps of Engineers, USGS, and the USFWS. Although these agencies are also responsible for complying with section 7 of the ESA because they are funding activities that may affect ESA-listed species or their designated critical habitats, this consultation considers the activities they propose to fund and will fulfill their section 7 consultation requirement.

The Applicants request multi-year permits to expire on or before December 31, 2006. The permit modifications also will expire on or before December 31, 2006. NOAA Fisheries expects that the holders of those permits will request extensions through December 31, 2006 or apply for new permits when the existing permits expire. Because the proposed activities will affect the same species and be conducted in the same general areas, NOAA Fisheries intends that this opinion be valid until December 31, 2006. If the status of any of the species changes, new information is received, or other circumstances contemplated by the reinitiation provisions arise, NOAA Fisheries will update this consultation. NOAA Fisheries may also modify or suspend permits based on new or different conditions and can alter take authorizations as needed.

Under section 10(d) of the ESA, NOAA Fisheries is prohibited from issuing a section 10(a)(1)(A) permit unless NOAA Fisheries finds that the permit (1) was applied for in good faith; (2) if granted and exercised, will not operate to the disadvantage of the endangered and/or threatened species that is/are the subject of the permit; and (3) is consistent with the purposes and policy of section 2 of the ESA. In addition, NOAA Fisheries does not issue a section 10(a)(1)(A) permit unless the proposed activities are likely to result in a net benefit to the ESA-listed species that is/are the subject of the permit. Benefits to ESA-listed species accrue from the acquisition of scientific information. For example, juvenile fish trapping efforts have enabled the production of population inventories, PIT-tagging efforts have increased the knowledge of anadromous fish migration timing and survival, and fish passage studies have provided an enhanced understanding of fish behavior and survival when moving past dams and through reservoirs. By issuing section 10(a)(1)(A) scientific research permits, NOAA Fisheries will cause information to be acquired that will enhance the ability of resource managers to make more effective and responsible decisions to sustain anadromous salmon and steelhead populations that are at risk of extinction, to mitigate impacts to endangered and threatened salmon and steelhead, and to implement recovery efforts. The resulting data will improve the knowledge of the species' life histories, specific biological requirements, genetic attributes, migration timing, responses to anthropogenic impacts, and survival in the river systems.

In general, the Applicants propose the following types of scientific research and monitoring activities: (1) Physiological testing of fish condition during collection, bypass, and transportation around hydropower dams; (2) determining fish distribution and habitat requirements through juvenile and adult salmonid surveys; (3) monitoring the condition of juvenile salmon and steelhead and investigating the migration timing and requirements of juvenile and adult salmonids; (4) determining adult escapement and juvenile production in tributaries; (5) monitoring adult and juvenile salmon and steelhead passage through dams and reservoirs; (6) determining the efficiency of the juvenile bypass facilities; (7) conducting habitat restoration studies; (8) conducting genetic monitoring studies using tissue or scale samples; (9) determining the status of supplementation efforts and their impact on the recovery of naturally-produced salmon and steelhead; (10) identifying factors contributing to juvenile salmon and steelhead stranding; (11) assessing the prevalence of disease; and (12) determining the biological effects of gas supersaturation. A number of research projects will focus on monitoring and evaluating management actions that are recommended for the recovery of ESA-listed salmon and steelhead populations. In addition, some of the permits will include takes of ESA-listed species associated with enhancement activities such as salvage/rescue operations.

The proposed activities involve harassing (e.g., passive observation by snorkeling or video camera, spawning ground surveys, or delaying adult fish at barriers), capturing, trapping, handling, tagging, marking, holding, transporting, and/or sacrificing ESA-listed salmon and steelhead. Methods of capturing fish include trapping in a weir, trap box, or other containment associated with a fish barrier, seining or netting, and electrofishing. The types of tags and/or marks likely to be used include passive integrated transponders (PIT), radio transmitters, fin clips, cheek tags, and/or balloon tags. Researchers will collect tissues and scale samples from live fish and fish carcasses and those tissues and scale samples will be transferred to a number of designated laboratories for archival and/or analysis.

The permits will include special conditions that Permit Holders are required to observe while conducting the proposed activities. These conditions are intended to (a) manage the interaction between scientists and ESA-listed salmonids by requiring that research activities be coordinated among Permit Holders and between Permit Holders and NOAA Fisheries, (b) require measures to minimize and mitigate the impacts on the target species, (c) require Permit Holders to notify NOAA Fisheries in the event of excessive or unauthorized takes of ESA-listed species, and (d) require Permit Holders to report to NOAA Fisheries annually on their activities and the effect that those activities have on the species concerned. The following Special Conditions will be included in the permits unless NOAA Fisheries determines that a specific condition is not applicable:

1. Anesthetize each ESA-listed fish that is handled out-of-water. Anesthetized fish must be allowed to recover (e.g., in a recovery tank) before being released. Fish that are simply counted must remain in water and do not need to be anesthetized.

2. Handle each ESA-listed fish with extreme care and keep them in water to the maximum extent possible during sampling and processing procedures. The holding units must contain adequate amounts of well-circulated water. When using gear that captures a mix

of species, ESA-listed fish must be processed first to minimize the duration of handling stress. The transfer of ESA-listed fish must be conducted using a sanctuary net when necessary to prevent the added stress of an out-of-water transfer.

3. Stop handling ESA-listed juvenile fish if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, ESA-listed fish may only be identified and counted.

4. Use a sterilized needle for each individual injection when using a passive integrated transponder tag (PIT-tag) to mark ESA-listed fish. This is done to minimize the transfer of pathogens between fish.

5. Notify NOAA Fisheries in advance of any changes in sampling locations or research protocols and obtain approval before implementing those changes.

6. Not intentionally kill (or cause to be killed) any ESA-listed species the permit authorizes to be taken, unless the permit allows lethal take.

7. Exercise due caution during spawning ground surveys to avoid disturbing, disrupting, or harassing ESA-listed adult salmonids when they are spawning. Whenever possible, walking in the stream must be avoided—especially in areas where ESA-listed salmonids are likely to spawn.

8. Use visual observation protocols instead of intrusive sampling methods whenever possible. This is especially appropriate when merely ascertaining whether anadromous fish are present. Snorkeling and streamside surveys should replace electrofishing procedures whenever possible.

9. Comply with NOAA Fisheries' backpack electrofishing guidelines when using backpack electroshocking equipment to collect ESA-listed fish.

10. Report to NOAA Fisheries whenever the authorized level of take is exceeded or if circumstances indicate that such an event is imminent. Notification should be made as soon as possible, but no later than two days after the authorized level of take is exceeded. Researchers must then submit a detailed written report. Pending review of these circumstances, NOAA Fisheries may suspend research activities or reinitiate consultation before allowing research activities to continue.

11. Submit to NOAA Fisheries a post-season report summarizing the results of the research. The report must include a detailed description of activities, the total number of fish taken at each location, an estimate of the number of ESA-listed fish taken at each location, the manner of take, the dates/locations of take, and a discussion of the degree to which the

research goals were met.

NOAA Fisheries may also include additional conditions in a permit based on unique circumstances or the specific mitigation measures proposed by an Applicant. Additional conditions to be included in the permits, if applicable, are identified in the following descriptions of the proposed activities for each individual permit action.

Finally, NOAA Fisheries will monitor the actual number of listed fish taken annually in the scientific research activities (as provided to NOAA Fisheries in annual reports or by other means) and shall adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels rise to the level where they are detrimental to the listed species.

The Individual Permits

The following table shows the total take from each ESU and the permits involving those takes.

2002 Take Totals By Species/ESU

Species	Adult Lethal	Adult Non-Lethal	Juvenile Lethal	Juvenile Non-Lethal	Permits
SnR Sockeye Salmon	0	0	5	179	1291, 1366
SnR Sp\Su Chinook	9	12	396	10,200	1322, 1362, 1363, 1366, 1370, 1386
SnR Fall Chinook	0	6	201	604	1322, 1364, 1366, 1386
SnR Steelhead	0	12	188	7160	1363, 1364, 1366, 1370, 1386

The permit applications contain specific information related to each of the proposed activities, including citations of literature, that discuss some of the impacts of proposed activities and methodologies on ESA-listed anadromous salmon and steelhead. A general description of the activities associated with each proposed permit action follows.

1291-Modification 1

The USGS in Cook, WA requests modification 1 to its permit for increased annual take of juvenile, endangered, SnR sockeye salmon associated with the research. The USGS is currently authorized under permit 1291 to annually take ESA-listed anadromous juvenile fish associated with scientific research at The Dalles and Bonneville Dams on the lower Columbia River. The purpose of the research is to monitor juvenile fish movement, distribution, behavior, and survival from John Day Dam downstream past Bonneville Dam using radiotelemetry technology. Up to

170 listed sockeye salmon juveniles are proposed to be captured by the USGS from the juvenile bypass facilities at the dams, sampled for biological information, and released. Up to 3 percent of the ESA-listed juvenile fish proposed to be handled by the USGS researchers and/or their designated agents may be killed unintentionally.

Permit 1322-Modification 1
The Fish Ecology Division, NWFSC, NOAA Fisheries, received a five year permit on February 21, 2002, for annual takes of juvenile, threatened, naturally-produced and artificially-propagated, SnR spring/summer chinook salmon; juvenile, threatened, SnR fall chinook salmon; and juvenile, threatened, SnR steelhead associated with a scientific research project proposed to occur in the lower Columbia River and estuary. The objective of the research is to identify associations between salmon and habitat. The approach will be to (1) determine the relationship between habitat and the presence, use, and benefit to juvenile salmon, with an emphasis on subyearling chinook salmon, and (2) understand the relationships between changes in flow, sediment input, and availability of habitat in the lower Columbia River and estuary. The need to develop effective restoration strategies requires that the benefits of estuarine habitats to juvenile salmon be identified by evaluating habitat-salmon linkages. The long history of wetland loss in the Columbia River estuary coupled with changes in flow patterns suggests that restoration of these habitats may benefit depressed salmon stocks. Information obtained from the research will serve as the basis for developing habitat restoration and preservation plans. NWFSC proposes to sample for the presence and abundance of salmon species in the estuary and lower Columbia River at monthly intervals throughout each annual period. ESA-listed juvenile salmon and steelhead are proposed to be captured with beach seines and trapnets, sampled for biological information, and released. ESA-listed juvenile fish indirect mortalities of 2 percent associated with the research are requested. In addition, NWFSC is also requesting intentional lethal takes of ESA-listed juvenile salmon for stomach content identification and the collection of scales and otoliths (NWFSC 2001b). Modification 1 to Permit 1322 includes transfer of fish tissue samples and an increase in the take of SnR Fall chinook salmon, and SnR spring/summer chinook salmon.

Permit 1362
The ICFWRU requests a 1–year permit (1362) for take of adult, threatened, artificially propagated, SnR spring/summer chinook salmon associated with a scientific research project proposed to occur at Bonneville Dam on the lower Columbia River. The objective of the research is to evaluate the energy costs, survival, and reproductive success of adult salmon associated with their passage around the hydropower dams on the mainstem Columbia and Snake Rivers. The research would benefit the species by evaluating the effects of passage history and energy use on reproductive success of adult salmon. Permit 1362 would authorize the ICFWRU annual takes of adult, threatened, artificially-propagated, SnR spring/summer chinook salmon associated with scientific research conducted at the Bonneville Dam on the lower Columbia River. Collection of adult ESA-listed salmon will be at the Adult Fish Facility (AFF) located near the Washington-shore fish ladder. The fish will be diverted into an anesthetic tank (MS-222 @ 100 mg/L, or clove oil @ 0.026 ml/L dissolved in

water and absorbed across the gills) via electronically controlled guide gates. Only those fish that received PIT tags as juveniles at McCall Hatchery will be selected. Once the selected fish are anesthetized they will be weighed and measured, sacrificed by applying a lethal dose of anesthesia (MS-222) and tissue samples for proximate analysis will be extracted and preserved on dry ice for shipping to the lab for analysis. Information collected from the research will be used directly by managers to operate fishways and manage spill and low regimes to maximize passage and survival of adult salmonids at the dams. As many as 9 adult, threatened, artificially propagated, SnR spring/summer chinook salmon that originated from the upper Salmon River region are proposed to be lethally taken in 2002 to obtain energy use data. In addition, ICFWRU requests take to collect tissues from ESA-listed adult salmon carcasses in the upper Salmon River region.

Permit 1363

The Fish Passage Center (FPC) requests a 5–year permit (1363) for annual takes of juvenile, threatened, naturally produced, SnR spring/summer chinook salmon and juvenile, threatened, SnR steelhead associated with a project designed to measure the smolt-to-adult survival rates of hatchery and wild spring/summer chinook salmon and hatchery steelhead from representative sites in the Snake, mid-Columbia River, and lower Columbia River basins. The data will be useful in the development of future long-term mitigation measures at the hydroelectric dams on the Snake and Columbia Rivers, such as flow augmentation, spill, and juvenile fish transportation. The wild runs of SnR spring and summer chinook salmon and steelhead were relatively strong in 2000 and 2001. An opportunity exists to tag enough wild juvenile chinook salmon and steelhead for the 2002 to 2004 outmigrations to provide a comparison between smolt-to adult survival rates of transported and in river wild migrants, as well as between Snake River and down river wild stocks with similar life history characteristics. ESA-listed juvenile salmon and steelhead are proposed to be captured at traps located on the Snake, Salmon, and Clearwater Rivers in Idaho and the Grande Ronde River in Oregon. Captured ESA-listed juvenile salmon and steelhead are proposed to be tagged with passive integrated transponders (PIT tags) and released. FPC estimates that as many as 167 ESA-listed juvenile salmon and as many as 100 ESA-listed juvenile steelhead indirect mortalities may occur each year associated with the research.

Permit 1364

The Idaho Fishery Resource Office of the USFWS requests a 1–year permit (1364) for takes of juvenile, threatened, SnR fall chinook salmon and juvenile, threatened, SnR steelhead associated with a continuing project designed to evaluate the Dworshak National Fish Hatchery steelhead program in Idaho and its impacts on ESA-listed salmon and steelhead in the vicinity of the hatchery. As a result of non-listed steelhead releases from the hatchery, the potential exists for competition, increased stress, behavior modification, predation, and genetic risks between hatchery steelhead and ESA-listed wild salmon and steelhead stocks. The goal of the project is to better understand the extent to which these potential risks affect ESA-listed salmon and steelhead stocks and to be able to recommend appropriate actions to limit those risks. ESA-listed juvenile salmon and steelhead are proposed to be observed/harassed during snorkel surveys or captured using boat or backpack electrofishing, sampled for biological information and tissue samples, and released. USFWS estimates that as many as five ESA-listed juvenile salmon and as many as 16 ESA-listed juvenile steelhead indirect mortalities may occur associated with the research.

Permit 1366
The OCFWRU requests a 5–year permit (1366) for annual takes of juvenile, endangered, SnR sockeye salmon, juvenile, threatened, SnR fall chinook salmon and juvenile, threatened, SnR steelhead, and juvenile, threatened, artificially-propagated and naturally-produced chinook salmon associated with a research project proposed to occur at Lower Granite Dam on the lower Snake River and McNary and Bonneville Dams on the lower Columbia River. The purpose of the research is to compare biological and physiological indices of wild and hatchery juvenile fish exposed to stress from bypass, collection, and transportation activities at the dams. The research will improve the survival of the ESA-listed species at the dams by providing information that will be used to determine the effects of the manmade structures and associated management activities on the outmigrating salmonids. ESA-listed juvenile fish are proposed to be captured using lift nets or dipnets at the dams (or acquired from Smolt Monitoring Program or NOAA Fisheries personnel at Bonneville Dam), sampled for biological information or tagged with radiotransmitters, and released. Up to 3 percent of the ESA-listed juvenile fish handled each year may be indirectly killed. In addition, OCFWRU requests intentional lethal takes of ESA-listed juvenile fish associated with the research.

Permit 1370
Utah State University (USU) requests a 1–year permit (1370) for annual takes of adult and juvenile, threatened, SnR spring/summer chinook salmon, and adult and juvenile, threatened, SnR steelhead associated with research designed to estimate populations of listed fish at various life stages. The study is a bull trout population assessment that will occur in the Imnaha River system where juvenile, threatened, SnR spring/summer chinook salmon, and adult and juvenile, threatened, SnR steelhead will be caught incidentally. The study will provide information that will allow researchers to improve SnR chinook and steelhead habitat. USU proposes to observe/harass juvenile and adult listed chinook and juveniles and adult listed steelhead during snorkel and coring operations. USU proposes to capture (using boat electrofishing and blocknets), handle and release juvenile SnR spring/summer chinook salmon and juvenile and adult SnR steelhead. USU also requests indirect mortality of 2% of juvenile SnR chinook salmon and juvenile SnR steelhead associated with the research.

Permit 1386
The WDOE requests a 5-year permit for annual takes of threatened, adult and juvenile, naturally-produced and artificially-propagated, SnR spring/summer chinook salmon; threatened, adult and juvenile, SnR fall chinook salmon; and threatened, adult and juvenile, SnR steelhead, associated with research in the state of Washington associated with a project proposed to occur in various streams and tributaries throughout the state. The objective of the research is to investigate the occurrence and monitor the concentrations of toxic contaminants in edible fish tissue and the freshwater environments of the state as part of the Washington State Toxics Monitoring Program. Threatened, adult and juvenile, naturally-produced and artificially-propagated, SnR spring/summer chinook salmon; threatened, adult and juvenile, SnR fall chinook salmon; and threatened, adult and juvenile, SnR steelhead, from the Snake River in Washington state are

proposed to be captured annually (using nets, seines, or electrofishing), sampled for biological information, and released. Up to 2 percent of the ESA-listed juvenile fish proposed to be handled by WDOE researchers may be killed unintentionally.

The Action Areas

The action area for endangered SnR sockeye salmon is the Stanley River subbasin in Idaho including the species' designated critical habitat (NOAA 1993b). The action area for the species includes river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams). Included are adjacent riparian zones and mainstem river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches from the confluence of the Columbia River upstream to the confluence of the Salmon River; all Salmon River reaches from the confluence of the Snake River upstream to Alturas Lake Creek; Stanley, Redfish, Yellow Belly, Pettit, and Alturas Lakes (including their inlet and outlet creeks); and Alturas Lake Creek and that portion of Valley Creek between Stanley Lake Creek and the Salmon River. Watersheds containing spawning and rearing habitat for this ESU comprise approximately 510 square miles in Idaho. The watersheds lie partially or wholly within Blaine and Custer counties.

The action area for threatened SnR spring/summer chinook salmon is the mainstem Snake River, the Tucannon River subbasin, the Grande Ronde River subbasin, the Imnaha River subbasin, the Salmon River subbasin, and includes the species' designated critical habitat (NOAA 1993b and NOAA 1999). The action area for the species includes river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams). Included are adjacent riparian zones, as well as mainstem river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the confluence of the Columbia and Snake Rivers and all Snake River reaches from the confluence of the Columbia River upstream to Hells Canyon Dam. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 22,390 square miles in Idaho, Oregon, and Washington. The following counties lie partially or wholly within these basins: Idaho - Adams, Blaine, Custer, Idaho, Lemhi, Lewis, Nez Perce, and Valley; Oregon - Baker, Umatilla, Union, and Wallowa; Washington - Adams, Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman.

The action area for threatened SnR fall chinook salmon is the mainstem Snake River, the Tucannon River subbasin, the Grande Ronde River subbasin, the Imnaha River subbasin, the Salmon River subbasin, the Clearwater River subbasin, and includes the species' designated critical habitat (NOAA 1993b). The action area for the species includes river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams). Included are adjacent riparian zones, as well as mainstem river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the confluence of the Columbia and Snake Rivers; the Snake River including all river reaches from the confluence of the Columbia River upstream to Hells Canyon Dam; the Palouse River from its confluence with the Snake River upstream to Palouse Falls; the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek; and the North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 13,679 square miles in Idaho, Oregon, and Washington. The following counties lie partially or wholly within these basins: Idaho - Adams, Clearwater, Idaho, Latah, Lemhi, Lewis, and Nez Perce; Oregon - Baker, Union, and Wallowa; Washington - Adams, Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman.

The action area for threatened SnR steelhead is the Snake River Basin of Idaho, southeast Washington, and northeast Oregon. The action area for the species includes river reaches presently or historically accessible in the Snake River and its tributaries in Idaho, Oregon, and Washington. Included are mainstem river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the confluence of the Columbia and Snake Rivers. Excluded are tribal lands and areas above specific dams (such as Dworshak and Hells Canyon Dams) and areas above longstanding, naturally impassable barriers (i.e., Napias Creek Falls and other natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 29,282 square miles in Idaho, Oregon, and Washington. The following counties lie partially or wholly within these basins: Idaho - Adams, Blaine, Boise, Clearwater, Custer, Idaho, Latah, Lemhi, Lewis, Nez Perce, and Valley; Oregon - Baker, Umatilla, Union, and Wallowa; Washington - Adams, Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman. More detailed habitat information (i.e., specific watersheds, migration barriers, habitat features, and special management considerations) for SnR steelhead can be found in the February 16, 2000, *Federal Register* notice designating critical habitat (65 FR 7764). It should be noted, however, that the critical habitat designation for SnR steelhead was vacated and remanded to NOAA Fisheries for new rulemaking pursuant to a court order in May of 2002. In the absence of a new rule designating critical habitat for MCR steelhead, this consultation will evaluate the effects of the proposed actions on the species' habitat to determine whether those actions are likely to jeopardize the species' continued existence.

STATUS OF SPECIES UNDER THE ENVIRONMENTAL BASELINE

The actions considered in this biological opinion will affect endangered SnR sockeye salmon, threatened SnR spring/summer chinook salmon, threatened SnR fall chinook salmon, and threatened SnR steelhead.

Snake River Sockeye Salmon

The SnR sockeye salmon ESU, listed as endangered on November 20, 1991 (NOAA 1991), includes populations of sockeye salmon from the Snake River Basin, Idaho (extant populations occur only in the Salmon River subbasin). Under NOAA Fisheries' interim policy on artificial propagation (NOAA 1993a), the progeny of fish from a listed population that are propagated artificially are considered part of the ESA-listed species and are protected under ESA. Thus, although not specifically designated in the 1991 listing, SnR sockeye salmon produced in IDFG's captive broodstock program are included in the ESA-listed ESU. Given the dire status of the wild population under any criteria (16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000), NOAA Fisheries considers the captive broodstock and its progeny essential for recovery. In 2001, 36 adult sockeye were counted at Lower Granite Dam (FPC, 2002). Critical habitat was designated for SR sockeye salmon on December 28, 1993 (NOAA 1993b).

Information on the status and distribution of endangered SnR sockeye salmon is found in the status review prepared by the Northwest Fisheries Science Center, NOAA Fisheries (Waples *et al*. 1991a). More recent information on the status and distribution of the sockeye salmon ESU, including hatchery components, is provided in the status review update prepared by the Northwest Fisheries Science Center, NOAA Fisheries (Gustafson *et al.* 1997). Information on critical habitat for endangered SnR sockeye salmon is found in the *Federal Register* notice that designates critical habitat for this species (NOAA 1993b).

Snake River sockeye salmon adults enter the Columbia River primarily during June and July. Arrival at Redfish Lake, which now supports the only remaining run of Snake River sockeye salmon, peaks in August, and spawning occurs primarily in October (Bjornn *et al.* 1968). Eggs hatch in the spring between 80 and 140 days after spawning. Fry remain in the gravel for 3 to 5 weeks, emerge from April through May, and move immediately into the lake. Once there, juveniles feed on plankton for 1 to 3 years before they migrate to the ocean (Bell 1986). Migrants leave Redfish Lake during late April through May (Bjornn *et al.* 1968) and travel almost 900 miles to the Pacific Ocean. Smolts reaching the ocean remain inshore or within the influence of the Columbia River plume during the early summer months. Later, they migrate through the northeast Pacific Ocean (Hart 1973, Hartt and Dell 1986). Snake River sockeye salmon spend 2 to 3 years in the Pacific Ocean and return in their fourth or fifth year of life.

Historically, Snake River sockeye salmon were produced in the Salmon River subbasin in Alturas, Pettit, Redfish, and Stanley lakes and in the South Fork Salmon River subbasin in Warm Lake. Sockeye salmon may have been present in one or two other Stanley basin lakes (Bjornn *et al.* 1968). Elsewhere in the Snake River Basin, sockeye salmon were produced in Big Payette Lake on the North Fork Payette River and in Wallowa Lake on the Wallowa River (Evermann

1895, Toner 1960, Bjornn *et al.* 1968, Fulton 1970).

Escapement of sockeye salmon to the Snake River has declined dramatically in the last several decades, primarily because the construction of hydropower dams made it difficult for sockeye salmon to have access to traditional spawning areas. Adult counts at Ice Harbor Dam declined from 3,170 in 1965 to zero in 1990 (ODFW and WDFW 1999). The Idaho Department of Fish and Game counted adults at a weir in Redfish Lake Creek during 1954 through 1966; adult counts dropped from 4,361 in 1955 to fewer than 500 after 1957 (Bjornn *et al.* 1968). A total of 16 wild sockeye salmon returned to Redfish Lake between 1991 and 1999. During 1999, seven hatchery-produced, age-3 adults returned to the Sawtooth Hatchery. Three of these adults were released to spawn naturally, and four were taken into the IDFG captive broodstock program. In 2000, 257 hatchery-produced, age-4 sockeye salmon returned to the Stanley basin (weirs at the Sawtooth Hatchery and Redfish Lake Creek). Adults numbering 243 were handled and redistributed to Redfish (120), Alturas (52), and Pettit (28) lakes, with the remaining 43 adults incorporated into the IDFG captive broodstock program.

Low numbers of adult Snake River sockeye salmon preclude a quantitative analysis of the status of this ESU. However, because only16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000, NOAA Fisheries considers the status of this ESU to be dire under any criteria.

<u>Chinook Salmon</u>

The chinook salmon is the largest of the Pacific salmon. The species' distribution historically ranged from the Ventura River in California to Point Hope, Alaska, in North America, and in northeastern Asia from Hokkaido, Japan, to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit the most diverse and complex life history strategies. Healey (1986) described 16 age categories for chinook salmon, combinations of seven total ages with three possible freshwater ages. This level of complexity is roughly comparable to that seen in sockeye salmon, although the latter species has a more extended freshwater residence period and uses different freshwater habitats (Miller and Brannon 1982, Burgner 1991). Gilbert (1912) initially described two generalized freshwater life-history types: "stream-type" chinook salmon, which reside in freshwater for a year or more following emergence, and "ocean-type" chinook salmon, which migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for ocean-type and stream-type to describe two distinct races of chinook salmon. Healey's approach incorporates life-history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations.

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater; migration to the ocean; and the subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. The juvenile rearing period in freshwater can be minimal or extended. Additionally, some male chinook salmon mature in freshwater, thereby not emigrating to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Although salmon exhibit a high degree of variability in life-history traits, there is considerable debate regarding the degree to which this variability is shaped by local adaptation or results from the general plasticity of the salmonid genome (Ricker 1972, Healey 1991, Taylor 1991).

Snake River Spring/Summer Chinook Salmon

The Fish Passage Center's Annual report for 2001 reported that approximately 15,300 adult summer chinook were counted at Ice Harbor Dam with nearly 14,000 passing Lower Granite Dam in 2001. The summer chinook count at Lower Granite was about 3.5 times greater than the 2000 and 10-year average. Snake River summer chinook are mainly destined for the South Fork of the Salmon River and its tributaries and Pahsimeroi River. The 2002 forecast by TAC is estimated to be near 17,000 adult summer chinook for the Snake River.

The reported count of spring chinook in 2001 at Lower Granite Dam was 171,958, about 4.3 times greater than the next highest count since 1975. Estimated hatchery chinook at Lower Granite Dam comprised a minimum of 76% of the run [note that this percentage is based only on the absence of the adipose fin] (FPC, 2002).

The SnR spring/summer chinook salmon ESU, listed as threatened on April 22, 1992 (NOAA 1992), includes all natural-origin populations in the Tucannon, Grande Ronde, Imnaha, and Salmon Rivers. Some or all of the fish returning to several of the hatchery programs are also listed including those returning to the Tucannon River, Imnaha River, and Grande Ronde River hatcheries, and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. Critical habitat was designated for SnR spring/summer chinook salmon on December 28, 1993 (NOAA 1993b), and was revised on October 25, 1999 (NOAA 1999).

Information on the status and distribution of SnR spring/summer chinook salmon is found in the status review prepared by the Northwest Fisheries Science Center, NMFS (Matthews and Waples 1991). More recent information on the status and distribution of the chinook salmon ESU, including hatchery components of the respective populations, is provided in the Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California prepared by the West Coast Chinook Salmon Biological Review Team (Myers *et al.* 1998) and the Evaluation of the Status of Chinook and Chum Salmon and Steelhead Hatchery Populations for ESUs Identified in Final Listing Determinations prepared by the Conservation Biology Division of the NWFSC (NMFS 1999a). Information on critical habitat for threatened SnR spring/summer chinook salmon is found in the *Federal Register* notice that designates critical habitat for this species (NOAA 1993b) and the *Federal Register* notice that revised the critical habitat designation for the species (NOAA 1999).

The present range of spawning and rearing habitat for naturally spawned SnR spring/summer chinook salmon is primarily limited to the Salmon, Grande Ronde, Imnaha, and Tucannon River subbasins. Most SnR spring/summer chinook salmon enter individual subbasins from May through September. Juvenile SnR spring/summer chinook salmon emerge from spawning gravels from February through June (Peery and Bjornn 1991). Typically, after rearing in their nursery streams for about 1 year, smolts begin migrating seaward in April and May (Bugert *et al.* 1990, Cannamela 1992). After reaching the mouth of the Columbia River, spring/summer chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration, which lasts 2 to 3 years.

Bevan *et al.* (1994) estimated the number of wild adult SnR spring/summer chinook salmon in the late 1800s to be more than 1.5 million fish annually. By the 1950s, the population had declined to an estimated 125,000 adults. Escapement estimates indicate that the population continued to decline through the 1970s. Returns varied through the 1980s, but have declined further in recent years. Record low returns were observed in 1994 and 1995. Dam counts were modestly higher from 1996 through 1998, but declined in 1999. For management purposes, the spring and summer chinook salmon in the Columbia River Basin, including those returning to the Snake River, have been managed as separate stocks. Historical databases, therefore, provide separate estimates for the spring and summer chinook salmon components.

NOAA Fisheries set an interim recovery level for SnR spring/summer chinook salmon (31,400 adults at Ice Harbor Dam) in its proposed recovery plan (NMFS 1995). The SnR spring/summer chinook salmon ESU consists of 39 local spawning populations (subpopulations) spread over a large geographic area (Lichatowich *et al.* 1993). The number of fish returning to Lower Granite Dam is, therefore, divided among these subpopulations. The relationships between these subpopulations, and particularly the degree to which individuals may intermix, are unknown. It is unlikely that all 39 are independent populations per the definition in McElhany *et al.* (2000), which requires that each be isolated such that the exchange of individuals between populations does not substantially affect population dynamics or extinction risk over a 100-year time frame. Nonetheless, monitoring the status of subpopulations provides more detailed information on the status of the species than would an aggregate measure of abundance.

For 2000, the preliminary final aggregate count for upriver spring chinook salmon at Bonneville Dam was 178,000. This is the second highest return in 30 years (after the 1972 return of 179,300 adults). Although only a small portion of these fish is expected to be natural-origin spring chinook salmon destined for the Snake River (5,800), the aggregate estimate for natural-origin SnR spring chinook salmon is substantially higher than the contributing brood year escapements. The 2000 forecast for the upriver summer chinook salmon stocks is 33,300, which is the second highest return in over 30 years, but with only a small portion (2,000) being natural-origin fish destined for the Snake River. The return of natural-origin fish compares to brood year escapements in 1995 and 1996 of 534 and 3,046 and is generally lower than the average returns over a recent 5- year period (3,466).

The probability of meeting survival and recovery objectives for SnR spring/summer chinook salmon under various future operation scenarios for the Federal Columbia River Power System (FCRPS) was analyzed through a process referred to as PATH (Plan for Analyzing and Testing Hypotheses). The scenarios analyzed focused on status quo management and options that emphasized either juvenile transportation or hydro-project drawdown. A 70 percent probability of exceeding the threshold escapement levels was used to assess survival. Recovery potential was assessed by comparing the projected abundance to the recovery abundance levels after 48 years. A 50 percent probability of exceeding the recovery abundance levels was used to evaluate recovery by comparing the 8-year mean projected abundance. In general, the survival and recovery standards were met for operational scenarios involving drawdown, but were not met under status quo management or for the scenarios that relied on juvenile transportation (Marmorek and Peters 1998). If the most conservative harvest rate schedule was assumed, transportation scenarios came very close to meeting the survival and recovery standards.

For the SnR spring/summer chinook salmon ESU as a whole, NOAA Fisheries estimates that the median population growth rate over the base period[1] ranges from 0.96 to 0.80, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to the effectiveness of fish of wild origin (McClure *et al.* 2000b). NOAA Fisheries has also estimated median population growth rates and the risk of absolute extinction for seven spring/summer chinook salmon index stocks, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years for the wild component ranges from zero for Johnson Creek to 0.78 for the Imnaha River (McClure *et al.* 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years ranges from zero for Johnson Creek to 1.00 for the wild component in the Imnaha River (McClure *et al.* 2000b).

Wild/natural spring and summer chinook returns to the Snake River

Year	Spring Chinook	Summer Chinook	Total
2000	8,049	846	8,895
2001[1]	49,407	2,473	51,880
2002[2]	24,100	5,300	29,400
Interim Abundance Target[3]			41,900
[1]*includes wild fish escapement to the Tucannon River located below Lower Granite Dam*			
[2] *preseason estimate*, 3/15/02 [3] *from Lohn 2002*			

Snake River Fall Chinook Salmon
The SnR fall chinook salmon ESU, listed as threatened on April 22, 1992 (NOAA 1992), includes all natural-origin populations of fall chinook in the mainstem Snake River and several tributaries including the Tucannon, Grande Ronde, Salmon, and Clearwater Rivers. Fall chinook salmon from the Lyons Ferry Hatchery are included in the ESU but are not listed. Critical habitat was designated for SnR fall chinook salmon on December 28, 1993 (NOAA 1993b).

Information on the status and distribution of SnR fall chinook salmon is found in the status review prepared by the Northwest Fisheries Science Center, NOAA Fisheries (Waples *et al.* 1991b). More recent information on the status and distribution of the chinook salmon ESU is provided in the Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California prepared by the West Coast Chinook Salmon Biological Review Team (Myers *et al.* 1998). Information on critical habitat for threatened SnR fall chinook salmon is found in the *Federal Register* notice that designates critical habitat for this species (NOAA 1993b).

The spawning grounds between Huntington (RM 328) and Auger Falls (RM 607) on the mainstem Snake River were historically the most important for this species. Only limited spawning activity was reported downstream from RM 273 (Waples *et al.* 1991b), about 1 mile upstream of Oxbow Dam. Since then, irrigation and hydrosystem projects on the mainstem Snake River have blocked access to or inundated much of this habitat causing the fish to seek out less preferable spawning grounds wherever they are available. Natural fall chinook salmon spawning now occurs primarily in the Snake River below Hells Canyon Dam and the lower reaches of the Clearwater, Grand Ronde, Salmon, and Tucannon Rivers.

Adult SnR fall chinook salmon enter the Columbia River in July and migrate into the Snake River from August through October. Fall chinook salmon generally spawn from October through November, and fry emerge from March through April. Downstream migration generally begins within several weeks of emergence (Becker 1970, Allen and Meekin 1973), and juveniles rear in backwaters and shallow water areas through mid-summer before smolting and migrating to the ocean—thus they exhibit an ocean-type juvenile history. Once in the ocean, they spend 1 to 4 years (though usually, 3 years) before beginning their spawning migration. Fall returns in the Snake River system are typically dominated by 4-year-old fish.

No reliable estimates of historical abundance are available. Because of their dependence on mainstem habitat for spawning, however, fall chinook salmon probably have been affected by the development of irrigation and hydroelectric projects to a greater extent than any other species of salmon. It has been estimated that the mean number of adult SnR fall chinook salmon declined from 72,000 in the 1930s and 1940s to 29,000 during the 1950s. Despite this decline, the Snake River remained the most important natural production area for fall chinook salmon in the entire Columbia River Basin through the 1950s. The number of adults counted at the uppermost Snake River mainstem dams averaged 12,720 total spawners from 1964 to 1968, 3,416 spawners from 1969 to 1974, and 610 spawners from 1975 to 1980 (Waples *et al.* 1991b).

Counts of natural-origin adult fish continued to decline through the 1980s, reaching a low of 78 individuals in 1990. Since then, the return of natural-origin fish to Lower Granite Dam has varied, but has generally increased, reaching a recent year high of 797 in 1997. The 1998 return declined to 306. This was not anticipated and is of particular concern because it is close to the low threshold escapement level of 300 that indicates increased risk (BRWG 1994). The low return in 1998 may have been due to severe flooding in 1995.

The return into the Snake River of 13,381 adult fall chinook was double the 2000 total; and the 10,000 jack salmon that returned nearly equaled the 2000 count but was 3.9 times greater than the 10-year average. Passage of adult fall chinook at Lower Granite Dam was 2.3 and 5.1 times greater than the respective 2000 and 10-year average (FPC 2002).

The recovery standard identified in the 1995 Proposed Recovery Plan (NMFS 1995) for SnR fall chinook salmon was a population of at least 2,500 naturally produced spawners (to be calculated as an 8-year geometric mean). Before the adult counts at Lower Granite Dam can be compared to the natural spawner escapement, adults that may fall back below the dam after counting must be accounted for, as well as prespawning mortality. A preliminary estimate suggested that a Lower Granite Dam count of 4,300 would be necessary to meet the 2,500-fish escapement goal (NMFS 1995). For comparison, the geometric mean of the Lower Granite Dam counts of natural-origin fall chinook salmon over a recent 8-year period was 481.

A further consideration regarding the status of SnR fall chinook salmon is the existence of the Lyons Ferry Hatchery stock which is considered part of the ESU. Several hundred adults have returned to the Lyons Ferry Hatchery in recent years. More recently, supplementation efforts designed to accelerate rebuilding were initiated, beginning with smolt outplants from the 1995 brood year. The existence of the Lyons Ferry program has been an important consideration in evaluating the status of the ESU, because it reduces the short-term risk of extinction by providing a reserve of fish from the ESU. Without the hatchery program, the risk of extinction would be considered high because the ESU would otherwise be comprised of a few hundred individuals from a single population, in marginal habitat, with a demonstrated record of low productivity. Although the supplementation program probably contributes to the population of natural-origin spawners, it does little to change the productivity of the system upon which a naturally spawning population must rely. Supplementation is, therefore, not a long-term substitute for recovery.

Recent analyses conducted through the PATH process considered the prospects for survival and recovery given several future management options for the hydrosystem and other mortality sectors (Marmorek and Peters 1998, Peters *et al.* 1999). That analysis indicated that the prospects of survival for SnR fall chinook salmon were good, but that full recovery was relatively unlikely except under a very limited range of assumptions, or unless drawdown was implemented for at least the four lower Snake River dams. Consideration of the drawdown options led to a high likelihood that both survival and recovery objectives could be achieved.

For the SnR fall chinook salmon ESU as a whole, NOAA Fisheries estimates that the median population growth rate over the base period[2] ranges from 0.94 to 0.86, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (McClure *et al.* 2000b). NOAA Fisheries has also estimated the risk of absolute extinction for the aggregate SnR fall chinook salmon population, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.40 (McClure *et al.* 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years is 1.00 (McClure *et al.* 2000b).

<u>Steelhead</u>
Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner *et al.* 1992). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in fresh water to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, whereas others only have one run type.

In the Pacific Northwest, summer steelhead enter fresh water between May and October (Busby *et al.* 1996). During summer and fall, before spawning, they hold in cool, deep pools. They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991). Winter steelhead enter fresh water between November and April in the Pacific Northwest (Nickelson *et al.* 1992), migrate to spawning areas, and then spawn in late winter or spring. Some adults do not, however, enter coastal streams until spring, just before spawning (Meehan and Bjornn 1991). Difficult field conditions (snowmelt and high stream flows) and the remoteness of spawning grounds contribute to the lack of specific information on steelhead spawning.

Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson *et al.* 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Multiple spawnings for steelhead

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[2] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1996 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

range from 3 percent to 20 percent of runs in Oregon coastal streams.

Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973), is required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn further upstream than winter steelhead (Withler 1966, Behnke 1992).

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (NOAA 1996) before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al.* 1992). Juveniles rear in fresh water from 1 to 4 years, then migrate to the ocean as smolts. Winter steelhead populations generally smolt after 2 years in fresh water (Busby *et al.* 1996). Steelhead typically reside in marine waters for 2 or 3 years before returning to their natal stream to spawn at 4 or 5 years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby *et al.* 1996).

Based on purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer, rather than migrating along the coastal belt as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986). Oregon steelhead tend to be north-migrating (Nicholas and Hankin 1988, Pearcy *et al.* 1990, Pearcy 1992).

Snake River Steelhead

The longest consistent indicator of steelhead abundance in the Snake River Basin is derived from counts of natural-origin steelhead at the uppermost dam on the lower Snake River. According to these estimates, the abundance of natural-origin summer steelhead at the uppermost dam on the Snake River has declined from a 4-year average of 58,300 in 1964 to a 4-year average of 8,300 ending in 1998. In general, steelhead abundance declined sharply in the early 1970s, rebuilt modestly from the mid-1970s through the 1980s, and declined again during the 1990s. The 2001 count at Ice Harbor Dam was 255,726 with Lower Granite reporting 262,558. Numbers of "wild" steelhead increased to about 47,700 at Lower Granite in 2001.(FPC, 2002)

These broad-scale trends in the abundance of steelhead were reviewed through the PATH process. The PATH report indicated that the initial, substantial decline coincided with the declining trend in downstream passage survival through the Federal hydrosystem. The more recent decline in abundance, observed over the last decade or more, does not coincide with declining passage survival, but can be at least partially be accounted for by a shift in climatic regimes that has affected ocean survival (Marmorek and Peters 1998).

The abundance of A-run versus B-run components of Snake River steelhead can be distinguished in data collected since 1985. Both components have declined through the 1990s, but the decline of B-run steelhead has been more significant. The 4-year average counts at Lower Granite Dam declined from 18,700 to 7,400 beginning in 1985 for A-run steelhead and from 5,100 to 900 for B-run steelhead. Recent counts have been stable for A-run steelhead and without apparent trend. Counts for B-run steelhead have been low and highly variable, but also without apparent trend.

A comparison of recent dam counts with escapement objectives provides perspective regarding the status of the ESU. The management objective for SnR steelhead stated in the Columbia River Fisheries Management Plan was to return 30,000 natural/wild steelhead to Lower Granite Dam. The All Species Review (TAC 1997) further clarified that this objective was subdivided into 20,000 A-run and 10,000 B-run steelhead. Idaho has reevaluated these escapement objectives using estimates of juvenile production capacity. This alternative methodology led to revised estimates of 22,000 for A-run and 31,400 for B-run steelhead.

The state of Idaho has conducted redd count surveys in the major subbasins since 1990. The surveys can be used as indicators of relative trends. The redd counts in natural-origin B-run production subbasins declined from 467 in 1990 to 59 in 1998. The declines are evident in all four of the primary B-run production areas. Index counts in the natural-origin A-run production areas have not been conducted with enough consistency to permit similar characterization.

Idaho has also conducted surveys for juvenile abundance in index areas throughout the Snake River Basin since 1985. Parr densities of A-run steelhead have declined from an average of about 75 percent of carrying capacity in 1985 to an average of about 35 percent in recent years through 1995. Further declines were observed in 1996 and 1997. Parr densities of B-run steelhead have been low, but relatively stable since 1985, averaging 10 percent to 15 percent of carrying capacity through 1995. Parr densities in B-run tributaries declined further in 1996 and 1997 to 11 percent and 8 percent, respectively.

The Snake River historically supported more than 55 percent of total natural-origin production of steelhead in the Columbia River Basin. It now has approximately 63 percent of the basin's natural production potential (Mealy 1997). B-run steelhead occupy four major subbasins, including two on the Clearwater River (Lochsa and Selway) and two on the Salmon River (Middle Fork and South Fork), areas that are for the most part not occupied by A-run steelhead. Some natural B-run steelhead are also produced in parts of the mainstem Clearwater and its major tributaries. There are alternative escapement objectives of 10,000 (Columbia River Fisheries Management Plan) and 31,400 (Idaho) for B-run steelhead. B-run steelhead, therefore, represent at least 1/3 and as much as 3/5 of the production capacity of the ESU.

B-run steelhead are distinguished from the A-run component by their unique life history characteristics. B-run steelhead were traditionally distinguished as larger fish with a later run timing, returning primarily to the South Fork Salmon, Middle Fork Salmon, Selway, and Lochsa Rivers. The recent review by the *U.S. v. Oregon* Technical Advisory Committee (TAC), a group that monitors adult salmon and steelhead escapement in the Snake River Basin, indicated that different populations of steelhead do have different size structures, with populations dominated by larger fish (i.e., greater than 77.5 cm) occurring in the traditionally defined B-run basins (TAC 1999). Larger fish occur in other populations throughout the basin, but at much lower rates. Evidence suggests that fish returning to the Middle Fork Salmon River and Little Salmon River have a more equal distribution of large and small fish. B-run steelhead also are generally older. A-run steelhead are predominately 1-ocean fish, whereas most B-run steelhead generally spend 2 or more years in the ocean before spawning. The differences in ocean age are primarily responsible for the differences in the size of A- and B-run steelhead. However, B-run steelhead are also thought to be larger at any given age than A-run fish. This may be due, at least in part, to the fact that B-run steelhead leave the ocean later in the year than A-run steelhead and thus have an extra month or more of ocean residence when growth rates are thought to be greatest.

Historically, a distinctly bimodal pattern of freshwater entry could be used to distinguish A-run and B-run fish. A-run steelhead were presumed to cross Bonneville Dam from June to late August, whereas B-run steelhead entered from late August to October. The *U.S. v. Oregon* TAC reviewed the available information on timing and confirmed that most large fish still have a later timing at Bonneville; 70 percent of the larger fish crossed the dam after August 26, the traditional cutoff date for separating A- and B-run fish (TAC 1999). However, the timing of the early part of the A-run has shifted somewhat later, thereby reducing the distinction that was so apparent in the 1960s and 1970s. The timing of the larger, natural-origin, B-run fish has not changed.

No recent genetic data are available for B-run steelhead populations in the South and Middle Forks of the Salmon River. The Dworshak National Fish Hatchery (NFH) stock and natural populations in the Selway and Lochsa Rivers are, thus far, the most genetically distinct populations of steelhead in the Snake River Basin (Waples *et al.* 1993). In addition, the Selway and Lochsa River populations from the Middle Fork Clearwater River appear to be very similar to each other genetically, and naturally produced rainbow trout from the North Fork Clearwater River (above Dworshak Reservoir) clearly show an ancestral genetic similarity to Dworshak NFH steelhead. The existing genetic data, the restricted geographic distribution of B-run steelhead in the Snake (Columbia) River Basin, and the unique life history attributes of these fish (i.e., larger, older adults with a later distribution of run timing compared to A-run steelhead in other portions of the Columbia River Basin) clearly support the conservation of B-run steelhead as a biologically significant component of the Snake River ESU.

NOAA Fisheries also considers the status of the component populations as an indicator of the status of the ESU. Because populations are relatively isolated, it is biologically meaningful to evaluate the risk of extinction of one population independently from any other. Although

NOAA Fisheries has not formally reviewed all the available information, it is reasonable to conclude that each of the major subbasins in the ESU represents a population within the context of this discussion. A-run populations would include at least the tributaries to the lower Clearwater River, the upper Salmon River and its tributaries, the lower Salmon River and its tributaries, the Grand Ronde River, Imnaha River, and possibly the Snake River's mainstem tributaries below Hells Canyon Dam. B-run populations would be identified in the Middle Fork and South Fork Salmon Rivers, the Lochsa and Selway Rivers (major tributaries of the upper Clearwater River), and the mainstem Clearwater River. These basins are, for the most part, large geographical areas and there probably is additional population structure within some of these basins. However, because that hypothesis has not been confirmed, NOAA Fisheries assumes that there are at least five populations of A-run steelhead and five populations of B-run steelhead in the SnR steelhead ESU.

Hatchery populations, if genetically similar to their natural-origin counterparts, provide a hedge against extinction of the ESU or the gene pool. The Imnaha River and Oxbow hatcheries produce A-run stocks that are currently included in the SnR steelhead ESU. The Pahsimeroi and Wallowa hatchery stocks may also be appropriate and available for use in developing supplementation programs. In its recent biological opinion on Columbia River Basin hatchery operations, NOAA Fisheries required that the Pahsimeroi hatchery program begin to transition to a local-origin broodstock to provide a source for future supplementation efforts in the lower Salmon River (NMFS 1999b). Although other stocks provide more immediate opportunities to initiate supplementation programs within some subbasins, it may also be necessary and desirable to develop additional broodstocks that can be used for supplementation in other natural production areas. Despite uncertainties, these hatchery stocks provide a safeguard against the further decline of natural-origin populations.

The Dworshak NFH is unique in the Snake River Basin because it produces a B-run hatchery stock. The Dworshak stock was developed from natural-origin steelhead within the North Fork Clearwater River, was largely free of introductions from other areas, and was, therefore, included in the ESU, although not as part of the ESA-listed component. However, past hatchery practices and possible changes in flow and temperature conditions related to Dworshak Dam have led to substantial divergence in spawn timing of the hatchery stock compared to what was observed historically in the North Fork Clearwater River and compared to the natural-origin populations in other parts of the Clearwater River Basin. Because the spawn timing of the hatchery stock is now much earlier than it was historically, the success of supplementation efforts using these stocks may be limited. In fact, past supplementation efforts in the South Fork Clearwater River using Dworshak NFH stock have been largely unsuccessful, although improvements in out-planting practices have the potential to yield different results. The unique genetic character of Dworshak NFH steelhead will limit the use of the stock for supplementation in other parts of the Clearwater River subbasin and in the Salmon River B-run basins.

For the SnR steelhead ESU as a whole, NOAA Fisheries estimates that the median population growth rate over the base period ranges from 0.91 to 0.70, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (McClure *et al.* 2000b). NOAA Fisheries has also estimated the risk of absolute extinction for the A- and B-runs, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.01 for A-run steelhead and 0.93 for B-run fish (McClure *et al.* 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years is 1.00 for both runs (McClure *et al.* 2000b).

FACTORS AFFECTING THE ENVIRONMENTAL BASELINE

The environmental baseline for this consultation is the result of several forms of activities, summarized below, that affect the survival and recovery of SnR sockeye salmon, SnR spring/summer chinook salmon, SnR fall chinook salmon, and SnR steelhead. The biological requirements of these species are currently not being met under their respective environmental baselines. Their status is such that there must be a significant improvement in the environmental conditions of the species' respective habitats (over those currently available under the environmental baselines). Any further degradation of the environmental conditions would have a significant impact due to the amount of risk the species presently face under the environmental baselines. In addition, there must be improvements to minimize impacts due to hydropower dams, incidental harvest, hatchery practices, and unfavorable estuarine and marine conditions.

The best scientific information presently available suggests that a multitude of factors, past and present, have contributed to the decline of West Coast salmonids. NOAA Fisheries reviewed much of that information in its recent consultation "Reinitiation of Consultation on Operation of the Federal Columbia River Power System (FCRPS), Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin" (NMFS 2000d), and that review is summarized here. NOAA Fisheries recognizes that natural environmental fluctuations have likely played a role in the species' recent declines. However, NOAA Fisheries believes that other human-induced impacts (e.g., harvest in certain fisheries, artificial propagation, water diversions, and widespread habitat modification) have played an equally significant role in the decline of these species. While at-risk salmonid stocks may benefit from a reversal in the current climate/ocean regime, resource managers need to focus on reducing impacts from harvest and artificial propagation and improving freshwater and estuarine habitats.

<u>The Species' Biological Requirements in the Action Areas</u>

SnR sockeye salmon, SnR spring/summer chinook salmon, SnR fall chinook salmon, and SnR steelhead reside in, or migrate through, the action areas considered in this consultation. The biological requirements during the species' life history stages can be obtained by identifying the essential features of their critical habitat. Essential features include adequate: (1) substrate (especially spawning gravel), (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) migration conditions (NOAA 2000a). As discussed below there are numerous factors affecting these requirements in the action areas.

Factors Affecting the Species in the Action Areas

Hydropower System

Anadromous salmonids in the Columbia River Basin have been dramatically affected by the development and operation of the FCRPS on the lower Snake and Columbia Rivers. Storage dams have eliminated spawning and rearing habitat and have altered the natural hydrograph of the Snake and Columbia Rivers, decreasing spring and summer flows and increasing fall and winter flows. Power operations cause flow levels and river elevations to fluctuate, affecting fish movement through reservoirs and riparian ecology, and stranding fish in shallow areas. The dams in the migration corridor alter smolt and adult migrations. Smolts experience a high level of mortality passing the dams. The dams also have converted the once-swift river into a series of slow-moving reservoirs, slowing the smolts' journey to the ocean and creating habitat for predators. Water velocities throughout the migration corridor now depend far more on volume runoff than before the development of the mainstem reservoirs.

There have been numerous changes in the operation and configuration of the FCRPS as a result of ESA consultations between NOAA Fisheries and the Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (Corps), USFWS, and the Bureau of Reclamation (BOR). The changes have improved survival for the ESA-listed fish migrating through the Snake and Columbia Rivers. Increased spill at the dams allows smolts to avoid both turbine intakes and bypass systems. Increased flow in the mainstem Snake and Columbia Rivers provides better inriver conditions for smolts. The transportation of smolts from the Snake River has also been improved by the addition of new barges and modification of existing barges. In addition to spill, flow, and transportation improvements, the Corps implemented numerous other improvements to project operations and maintenance at all FCRPS dams on the Snake and Columbia Rivers.

It is possible to quantify the survival benefits accruing from many of these strategies for each of the ESA-listed anadromous fish ESUs. For Snake River spring/summer chinook salmon smolts migrating inriver, the estimated survival through the hydrosystem is now between 40 percent and 60 percent, compared with an estimated survival rate during the 1970s of 5 percent to 40 percent. Snake River steelhead have probably received a similar benefit because their life history and run timing are similar to those of spring/summer chinook salmon (NMFS 2000b). It is more difficult to obtain direct data and compare survival improvements for fish transported from the Snake River, but there are likely to be improvements for transported fish as well. It is reasonable to expect that the improvements in operation and configuration of the FCRPS will benefit all ESA-listed Columbia River Basin salmonids and that the benefits will be greater the farther upriver the ESU. However, further improvements are necessary because the Federal hydropower system continues to cause a significant level of mortality for some ESUs.

Habitat Effects

The quality and quantity of freshwater habitat in much of the Columbia River Basin have declined dramatically in the last 150 years. Forestry, agriculture, road construction, hydrosystem development, mining, and urbanization have radically changed the historical habitat conditions of the basin. With the exception of fall chinook, which generally spawn and rear in the mainstem rivers, salmon and steelhead spawning and rearing habitat is found in the tributaries to the Snake and Columbia Rivers. Anadromous fish typically spend from a few months to three years rearing in freshwater tributaries. Depending on the species, they spend from a few days to one or two years in the Columbia River estuary before migrating out to the ocean and another one to four years in the ocean before returning as adults to spawn in their natal streams.

Water quality in streams throughout the Columbia River Basin has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and animal grazing, road construction, timber harvest activities, mining activities, and urbanization. Over 2,500 streams and river segments and lakes do not meet Federally-approved, state and Tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act. Tributary water quality problems contribute to poor water quality where sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

Most of the water bodies in Oregon, Washington, and Idaho that are on the 303(d) list do not meet water quality standards for temperature. Temperature alterations affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that result in high stream temperatures are the removal of trees or shrubs that directly shade streams, excessive water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals have contributed to lower base-stream flows, which in turn contribute to temperature increases. Channel widening and land uses that create shallower streams also cause temperature increases.

Pollutants also degrade water quality. Salmon require clean gravel for successful spawning, egg incubation, and the emergence of fry. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres of land in the basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban, and other uses can increase temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers.

On a larger landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density, which can affect the timing and duration of runoff. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have been developed. Urbanization paves over or compacts soil and increases the amount and pattern of runoff reaching rivers and streams.

Blockages that stop the downstream and upstream movement of fish exist at many agricultural, hydrosystem, municipal/industrial, and flood control dams and barriers. Highway culverts that are not designed for fish passage also block upstream migration. Migrating fish are diverted into unscreened or inadequately screened water conveyances or turbines, resulting in unnecessary mortality. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

Land ownership has played a part in habitat and land-use changes. Federal lands, which compose 50 percent of the basin, are generally forested and influence upstream portions of the watersheds. While there is substantial habitat degradation across all ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt *et al*. 1993, Frissell 1993, Henjum *et al*. 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence *et al*. 1996, ISG 1996). Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

Mainstem habitats of the Columbia and Snake Rivers have been affected by impoundments that have inundated large amounts of spawning and rearing habitat. Historically, fall chinook salmon spawned in the mainstem near The Dalles, Oregon, upstream to the Pend Oreille River in Washington and the Kootenai River in Idaho and in the Snake River downstream of Shoshone Falls. Current mainstem production areas for fall chinook salmon are mostly confined to the Hanford Reach of the mid-Columbia River and to the Hells Canyon Reach of the Snake River, with minor spawning populations elsewhere in the mid-Columbia River, below the lower Snake River dams, and below Bonneville Dam. Mainstem habitat in the Columbia and Snake Rivers has been reduced, for the most part, to a single channel, floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

The Columbia River estuary has also been changed by human activities. Navigation channels have been dredged, deepened and maintained, jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels, marsh and riparian habitats have been filled and diked, and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet. More than 50 percent of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted to other uses since 1948 (LCREP 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced, and the amount of water discharged during winter has increased.

The Basinwide Recovery Strategy (Federal Caucus 2000) outlines a broad range of current programs designed to improve habitat conditions for anadromous fish. Because most of the basin's anadromous fish spawning habitat is in Federal ownership, Federal land management programs are of primary importance. Examples of Federal actions likely to affect salmonids in the ESA-listed ESUs include authorized land management activities of the USFS and Bureau of Land Management (BLM). Federal actions, including the Corps' section 404 permitting activities under the Clean Water Act, the Corps' permitting activities under the River and Harbors Act, National Pollution Discharge Elimination System permits issued by EPA, highway projects authorized by the Federal Highway Administration, Federal Energy Regulatory Commission licenses for non-Federal development and operation of hydropower, and Federal hatcheries may result in impacts to ESA-listed anadromous fish.

Several recovery efforts are underway that may slow or reverse the decline of salmon and steelhead populations. Notable efforts within the range of the Snake River salmonid ESUs are the Northwest Forest Plan (NFP), PACFISH, Washington Wild Stock Restoration Initiative, and Washington Wild Salmonid Policy. PACFISH is an ecosystem-based aquatic habitat and riparian-area management strategy that covers the majority of the basin accessible to anadromous fish and includes specific prescriptions designed to halt habitat degradation. PACFISH provides objectives, standards, and guidelines that are applied to all Federal land management activities such as timber harvest, road construction, mining, grazing, and recreation. USFS and BLM implemented PACFISH beginning in 1995. Several other efforts are also being carried forward by NOAA Fisheries, USFS, and BLM. These components include (but are not limited to) implementation monitoring and accountability, a system of watersheds that are prioritized for protection and restoration, improved and monitored grazing systems, road system evaluation and planning requirements, mapping and analysis of unroaded areas, multi-year restoration strategies, and batching and analyzing projects at the watershed scale.

The most significant element of the NFP for anadromous fish is its Aquatic Conservation Strategy (ACS), a regional-scale aquatic ecosystem conservation strategy that includes: (1) Special land allocations (such as key watersheds, riparian reserves, and late-successional reserves) to provide aquatic habitat refugia; (2) special requirements for project planning and design in the form of standards and guidelines; and (3) new watershed analysis, watershed restoration, and monitoring processes. These components collectively ensure that Federal land management actions achieve ACS objectives that strive to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and to restore currently degraded habitats.

The Basinwide Recovery Strategy also outlines a large number of non-Federal habitat programs. Because non-Federal habitat is managed predominantly for private rather than public purposes, expectations for non-Federal habitat are harder to assess. Degradation of habitat for ESA-listed fish from activities on non-Federal lands is likely to continue to some degree, although at a reduced rate due to state, tribal, and local recovery plans. Because a substantial portion of land in the ESA-listed salmonid ESUs is in state or private ownership, conservation measures on these lands will be key to protecting and recovering ESA-listed salmon and steelhead populations. NOAA Fisheries recognizes that strong conservation benefits will accrue from specific components of many non-Federal conservation efforts, however, some of those conservation efforts are very recent and few address salmon conservation at a scale that is adequate to protect and conserve entire ESUs. NOAA Fisheries will continue to encourage non-Federal landowners to assess the impacts of their actions on ESA-listed salmonids. In particular, NOAA Fisheries will encourage state and local governments to use their existing authorities and programs, and will encourage the formation of watershed partnerships to promote conservation in accordance with ecosystem principles.

Hatcheries

For more than 100 years, hatcheries in the Pacific Northwest have been used to replace natural production lost as a result of the construction of hydropower dams and other development, not to protect and rebuild naturally-produced salmonid populations. As a result, most salmonid populations in the region are primarily hatchery fish. In 1987, for example, 95 percent of the coho salmon, 70 percent of the spring chinook salmon, 80 percent of the summer chinook salmon, 50 percent of the fall chinook salmon, and 70 percent of the steelhead returning to the Columbia River Basin originated in hatcheries (CBFWA 1990). While hatcheries certainly have contributed greatly to the overall numbers of salmonids, only recently has the effect of hatcheries on native wild populations been demonstrated. In many cases, these effects have been substantial. For example, the production of hatchery fish, among other factors, has contributed to the 90 percent reduction in wild coho salmon runs in the lower Columbia River over the past 30 years (Flagg *et al.* 1995).

NOAA Fisheries has identified four primary categories of risk that hatcheries can pose on wild-run salmon and steelhead: (1) ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NMFS 2000a). Ecologically, hatchery fish can increase predation on, displace, and/or compete with wild fish. These effects are likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods during which they may prey on or compete with wild fish. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release diseases into streams via water effluents. Genetically, hatchery fish can affect the genetic variability of native fish via interbreeding, either intentionally or accidentally. Interbreeding can also result from the introduction of native stocks from other areas. Theoretically, interbred fish are less adapted to and productive within the unique local habitats where the original native stock evolved.

Hatcheries have traditionally focused on providing fish for harvest, with less attention given to identifying and resolving factors causing declines of native runs. However, when wild fish mix with hatchery stock, fishing pressure can lead to overharvest of smaller or weaker wild stocks. Further, when migrating adult hatchery and wild fish mix on the spawning grounds, the health of the wild runs and the condition of the habitat's ability to support runs can be overestimated, because the hatchery fish mask surveyors' ability to discern actual wild run conditions.

The role of hatcheries in the future of Pacific Northwest salmon and steelhead is presently unclear; it will depend on the values people place on fish production and biological diversity. Clearly, conservation of biological diversity is gaining support, and the future role of hatcheries may shift toward judicial use of hatcheries to meet these goals rather than opposing them. One of the prime recommendations in the National Research Council's study of salmon in the Pacific Northwest is that hatchery use "should occur within the context of fully implemented adaptive-management programs that focus on watershed management, not just on the fish themselves" (NRC 1996).

Harvest Effects

Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational (sport fishing) began in the late 1800s, occurring primarily in tributary locations (ODFW and WDFW 1999).

Initially, the non-Indian fisheries targeted spring and summer chinook salmon, and these runs dominated the commercial harvest during the 1800s. Eventually the combined ocean and freshwater harvest rates for Columbia River spring and summer chinook salmon exceeded 80 percent and sometimes 90 percent of the run, contributing to the species' decline (Ricker 1959). From 1938 to 1955, the average harvest rate dropped to about 60 percent of the total spring chinook salmon run and appeared to have a minimal effect on subsequent returns (NMFS 1991). Until the spring of 2000, when a relatively large run of hatchery spring chinook salmon returned and provided a small commercial Tribal fishery, the last commercial season for spring chinook salmon had occurred in 1977. The summer chinook salmon run could not sustain the average harvest rate of 88 percent that was applied between 1938 to 1944 and produced lower returns between 1942 and 1949 (NMFS 1991). From 1945 through 1949, the Columbia River harvest rate on summer chinook salmon was reduced to about 47 percent, and subsequently, the run size increased. The construction of Grand Coulee Dam in 1941, with the resulting inundation of summer chinook salmon spawning areas, was a primary factor influencing this species' declining abundance. In the 1950s and 1960s, harvest rates further declined to about 20 percent (Raymond 1988). This species has not been the target of any commercial harvest since 1963.

Following the sharp declines in spring and summer chinook salmon in the late 1800s, fall chinook salmon became a more important component of the catch. Fall chinook salmon have provided the greatest contribution to Columbia River salmon catches in most years since 1890. The peak year of commercial sales was 1911, when 49.5 million pounds of fall chinook salmon were landed. Columbia River chinook salmon catches were generally stable from the beginning of commercial exploitation until the late 1940s, when landings declined by about two-thirds to a level that remained stable from the 1950s through the mid-1980s (ODFW and WDFW 1999). Since 1938, total salmonid landings have ranged from a high of about 2,112,500 fish in 1941 to a low of about 68,000 fish in 1995 (ODFW and WDFW 1999).

Whereas freshwater fisheries in the basin were declining during the first half of this century, ocean fisheries were growing, particularly after World War II. This trend occurred up and down the West Coast as fisheries with new gear types leapfrogged over the others to gain first access to the migrating salmon runs. Large, mixed-stock fisheries in the ocean gradually supplanted the freshwater fisheries, which were increasingly restricted or eliminated to protect spawning escapements. By 1949, the only freshwater commercial gear types remaining were gill nets, dip nets, and hoop nets (ODFW and WDFW 1999). Ocean trolling peaked in the 1950s; recreational fishing peaked in the 1970s. The ocean harvest has declined since the early 1980s as a result of declining fish populations and increased harvest restrictions (ODFW and WDFW 1999).

The construction of The Dalles Dam in 1957 had a major effect on Tribal fisheries. The Dalles Reservoir flooded Celilo Falls and inundated the site of a major Indian fishery that had existed for millennia. Commercial Indian landings at Celilo Falls from 1938 through 1956 ranged from 0.8 to 3.5 million pounds annually, based primarily on dip netting (ODFW and WDFW 1999). With the elimination of Celilo Falls, salmon harvest in the area declined dramatically. In 1957, in a joint action, the states of Oregon and Washington closed the Tribal fishery above Bonneville Dam to commercial harvesters. Treaty Indian fisheries that continued during 1957 through 1968 were conducted under Tribal ordinances. In 1968, with the Supreme Court opinion on the appeal of the *Puyallup v. Washington* case, the states reopened the area to commercial fishing by treaty Indians (ODFW and WDFW 1999). For the next 6 years, until 1974, only a limited Tribal harvest occurred above Bonneville Dam.

The capacity of salmonids to produce more adults than are needed for spawning offers the potential for sustainable harvest of naturally-produced fish. This potential can be realized only if two basic management requirements are met: (1) enough adults return to spawn and perpetuate the run, and (2) the productive capacity of the habitat is maintained. Catches may fluctuate in response to such variables as ocean productivity cycles, periods of drought, and natural disturbance events. However, as long as the two management requirements are met, fishing can be sustained indefinitely. Unfortunately, both prerequisites for sustainable harvest have been violated routinely in the past. The lack of coordinated management across jurisdictions, combined with competitive economic pressures to increase catches or to sustain them in periods of lower production, resulted in harvests that were too high and escapements that were too low. At the same time, habitat has been increasingly degraded, reducing the capacity of the salmon stocks to produce numbers in excess of their spawning escapement requirements.

For years, the response to declining catches was hatchery construction to produce more fish. Because hatcheries require fewer adults to sustain their production, harvest rates in the fisheries were allowed to remain high, or even increase, further exacerbating the effects of overfishing on the naturally-produced (non-hatchery) runs. More recently, harvest managers have instituted reforms including weak stock, abundance-based, harvest rate, and escapement-goal management.

Natural Conditions

Changes in the abundance of salmonid populations are substantially affected by changes in the freshwater and marine environments. Recent evidence suggests that marine survival of salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Hare *et al*. 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation. For example, large-scale climatic regimes, such as El Niño, appear to affect changes in ocean productivity. During the first part of the 1990s much of the Pacific Coast was subject to a series of very dry years. In more recent years, severe flooding has adversely affected some stocks. Thus, the survival and recovery of these species will depend on their ability to persist through periods of low natural survival rates.

A key factor affecting many West Coast stocks has been the general pattern of a 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a subadult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries of subadults relative to the number of CWTs released from that brood year. Time-series of survival rate information for upper Willamette River spring chinook salmon, Lewis River fall chinook salmon, and Skagit River fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent years (NMFS 1999b).

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to significant natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, has resulted in substantial mortality for salmonids. In recent years, for example, sea lions have learned to target upper Willamette River spring chinook salmon in the fish ladder at Willamette Falls.

Studies begun in 1997 by the Oregon Cooperative Fish and Wildlife Research Unit, USGS, and CRITFC have shown that fish-eating birds that nest on islands in the Columbia River estuary (Caspian terns, double-crested cormorants, and glaucous-winged gulls) are significant avian predators of juvenile salmonids. Researchers estimated that the tern population on Rice Island (16,000 birds in 1997) consumed 6 to 25 million outmigrating smolts during 1997 (Roby *et al.*1998) and 7 to 15 million outmigrating smolts during 1998 (Collis *et al*. 1999). The observed levels of predation prompted the regional fish and wildlife managers to investigate the feasibility of management actions to reduce the impacts. Early management actions appear to have reduced predation rates; researchers estimate that terns consumed 7.3 million smolts during 1999 (Columbia Bird Research 2000).

Finally, it should be noted that the unusual drought conditions in 2001 warrant additional consideration. The available water in the Columbia River Basin is 50-60 percent of normal and will result in some of the lowest flow conditions on record. These conditions will have the greatest effect on upriver stocks such as the ones being discussed in this opinion. The juveniles that must pass down river during the 2001 spring and summer out-migration will likely be affected and this, in turn, will affect adult returns primarily in 2003 and 2004, depending on the stock and species. At this time, it is impossible to ascertain what those effects will be, but NOAA Fisheries is carefully monitoring the situation and will take the drought condition into account in any management decision, including amending take authorizations and other permit conditions.

Scientific Research

Snake River salmon and steelhead, like other ESA-listed fish, are the subject of scientific research, monitoring, and enhancement activities. Most biological opinions that NOAA

Fisheries issues recommend specific monitoring, evaluation, and research projects to gather information to aid in the survival of the ESA-listed fish. In addition, NOAA Fisheries has issued numerous research and/or enhancement permits authorizing takes of ESA-listed fish over the past eight years. Each authorization for take by itself would not lead to decline of the species. However the sum of the authorized takes indicate a high level of research effort in the action area, and as anadromous fish stocks have continued to decline, the proportion of fish handled for research/monitoring purposes relative to the total number of fish has increased. The effect of these activities is difficult to assess, nevertheless, the potential benefits to ESA-listed salmon and steelhead from the scientific information is likely to be greater than the potential risk to the species due to those efforts. Potential benefits include enhancing the scientific knowledge base for the species, answering questions or contributing information toward resolving difficult resource management issues, and directly enhancing the survival of the species. The information gained during research and monitoring activities is essential to assist resource managers in making more informed decisions regarding recovery measures. Moreover, scientific research, monitoring, and enhancement efforts are not considered to be a factor for the decline of salmon and steelhead populations.

To reduce adverse effects from research and enhancement activities on the species, NOAA Fisheries imposes conditions in its permits so that Permit Holders are required to conduct their activities in such a way as to minimize adverse effects on the ESA-listed species, including keeping mortalities as low as possible. Also, researchers are encouraged to use non-listed fish species and/or ESA-listed hatchery fish, instead of ESA-listed, naturally-produced fish, for scientific research purposes when possible. In addition, researchers are required to share sample fish, as well as the results of the scientific research, with other researchers as a way to avoid duplicative efforts and to acquire as much information as possible from the ESA-listed fish sampled. NOAA Fisheries works with other agencies to coordinate research to prevent duplication of effort.

In general, for research and enhancement projects that require a section 10(a)(1)(A) permit, applicants will provide NOAA Fisheries with high take estimates to compensate for potential inseason changes to research protocols, accidental catastrophic events, and the annual variability in ESA-listed fish numbers. Also, most research projects depend on annual funding and the availability of other resources. So, a specific research project for which take of ESA-listed species is authorized by a permit may be suspended in a year when funding or resources are not available. Therefore, the actual take in a given year for most research and enhancement projects, as provided to NOAA Fisheries in post-season annual reports, is usually less than the authorized level of take in the permits and the related NOAA Fisheries consultation on the issuance of those permits. Therefore, because actual take levels tend to be lower than authorized takes, the severity of effects to the ESA-listed species are usually less than the effects analyzed in a typical consultation.

A substantial amount of the annual take of ESA-listed salmon and steelhead is related to assessing the impact of the hydropower dams on the mainstem Snake and Columbia Rivers. Scientific research, monitoring, and enhancement activities are required by the Reasonable and Prudent Alternative of the "Reinitiation of Consultation on Operation of the FCRPS, Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin" (NMFS 2000d). The Corps' Juvenile Fish Transportation Program results in a substantial amount of annual take of ESA-listed Snake River salmon and steelhead for enhancement purposes (to get the outmigrating juvenile fish past the concrete dams). For a description of the annual takes of ESA-listed Snake River salmon and steelhead associated with the hydropower dams on the mainstem Snake and Columbia Rivers, refer to the December 21, 2000 FCRPS biological opinion (NMFS 2000d) and the biological opinion on the *"Issuance of an Amendment of ESA Section 10(a)(1)(A) Permit 1237 for Takes of Six Endangered or Threatened Species for the Purpose of Enhancement"* issued on April 26, 2001 (NMFS 2001).

ANALYSIS OF THE EFFECTS OF THE PROPOSED ACTIONS

Description of Effects on Critical Habitat

In general, the types of activities that could result in impacts to critical habitat (except for steelhead which has no critical habitat designated) include streamside surveys, instream surveys, and the use of nets, seines, smolt traps, and electrofishing to obtain fish for research purposes. There will be a minimal amount of disturbance to vegetation, and no harm to spawning or rearing habitat, or to water quantity and water quality. Many of these activities will be of short duration, during limited field opportunities linked to migration patterns of the targeted populations. Thus, there will be minimal effects on the species' respective critical habitats from the actions discussed in this consultation. Additionally, the effects are not likely to be substantial enough to contribute to a decline in the values of the habitat.

Description of Effects on Snake River Salmon and Steelhead

The purpose of this section is to identify the effects on endangered SnR sockeye salmon, threatened SnR spring/summer chinook salmon, threatened SnR fall chinook salmon, and threatened SnR steelhead due to the issuance of scientific research and/or enhancement permits. For some of the research activities, the takes of ESA-listed salmon and steelhead occur on the mainstem rivers and/or at the hydropower dams on the mainstem rivers. Researchers are not able to distinguish between the respective species' populations when working outside of the tributary watersheds from which the fish originate. As such, for research that occurs on the mainstem rivers, the analyses are not sensitive enough to evaluate the effects of proposed activities on the ESA-listed species at the population level because of insufficient information. To the extent currently possible, this consultation will include analyses of effects at the population level. Where information on ESA-listed salmon and steelhead at the population level does not exist, this consultation assumes that the status of each affected population is the same as the respective ESU as a whole. The general effects of scientific research activities are discussed first followed by detailed analyses of permit specific effects.

ESA-listed juvenile salmon and steelhead abundance can vary considerably from year-to-year based on levels of adult escapement, natural fluctuations in environmental conditions, or anthropogenic effects. In addition, the number of ESA-listed juvenile fish impacted by the scientific research that occurs on the mainstem Snake and Columbia Rivers is directly related to the proportion of fish transported by barge and truck around the hydropower dams each year as part of the Corps' Juvenile Fish Transportation Program. In an effort to estimate juvenile salmon and steelhead abundance, the Northwest Fisheries Science Center, NOAA Fisheries has developed an algorithm that is used each year to calculate juvenile salmon and steelhead outmigration levels at the hydropower dams on the mainstem Snake and Columbia Rivers. These estimates have become a standardized tool that is used by virtually all the Permit Holders in the region to estimate annual ESA-listed juvenile fish takes associated with their respective activities. Schiewe (2002) provides the ESA-listed juvenile salmon and steelhead outmigration estimates for 2002.

The various proposed activities would cause many types of take, and while there is some blurring of the lines between what constitutes an activity (e.g., electrofishing) and what constitutes a take category (e.g., harm), it is important to keep the two concepts separate. The reason for this is that the effects being measured here are those which the activity itself has on the ESA-listed species. They may be expressed in terms of the take categories (e.g., how many SnR spring/summer chinook salmon are harmed, or harassed, or even killed), but the actual mechanisms of the effects themselves (i.e., the activities) are the causes of whatever take arises and, as such, they bear examination. Therefore, the first part of this section is devoted to a discussion of the general effects known to be caused by the proposed activities.

The following subsections describe the types of activities being proposed. Because they would all be carried out by trained professionals using established protocols and have widely recognized specific impacts, each activity is described in terms broad enough to apply to every proposed permit action. This is especially true in light of the fact that the researchers would not receive a permit unless their activities (e.g., electrofishing) incorporate NOAA Fisheries' uniform, pre-established set of mitigation measures. These measures are described in the *Description of the Proposed Actions* section above. They are incorporated (where relevant) into every permit as part of the terms and conditions to which a researcher must adhere.

Observation/Harassment

Harassment is a primary form of take associated with the proposed activities, and includes stress and other sub-lethal effects from observation and capture/handling. The ESA does not define harassment nor has NOAA Fisheries defined this term through regulation pursuant to the ESA. However, USFWS defines "harassment as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering" [50 CFR 17.4]. For the purposes of this analysis, NOAA Fisheries adopts this definition of harassment.

For some studies, ESA-listed fish will be observed in-water (e.g., snorkel surveys). Direct observation is the least disruptive and simplest method for determining presence/absence of the species and estimating the relative abundance. Typically, a cautious observer is effective in obtaining data without disrupting the normal behavior of a fish. Fry and juveniles frightened by the water turbulence and sound created by observers are likely to seek temporary refuge behind rocks, vegetation, and deep water areas. In extreme cases, some individuals may temporarily leave the particular pool or habitat type when observers are in their area. Researchers minimize disturbance to fish by moving through streams slowly thus allowing ample time for fish to reach escape cover. During some research activities, redds may be visually inspected, but no redds will be walked on. Harassment is the primary form of take associated with these observation activities, and few if any injuries or deaths are expected to occur. Based on prior research experience, the proposed observation/harassment of ESA-listed fish should not have any long-term, adverse effects on any of the species' populations or the species as a whole.

Capture/Handling

All sampling, handling, and tagging procedures carry an inherent potential for causing stress, disease transmission, injury, or death. Based on prior experience with the research techniques and protocols to be used to conduct the scientific research, unintentional mortality of ESA-listed juvenile salmon and steelhead expected to occur from the capture and handling procedures is not likely to exceed five percent of the fish subjected to handling, and in most cases, unintentional mortality of ESA-listed juvenile fish will not exceed two percent. Based on prior experience with the research techniques and protocols to be used to conduct the scientific research, unintentional mortality of ESA-listed adult salmon and steelhead expected to occur from the capture and handling procedures is not likely to exceed one percent of the fish subjected to handling. ESA-listed adult and juvenile fish indirect mortalities may be retained as reference specimens or used for analytical research purposes.

The handling process is likely to cause some stress on ESA-listed fish. Typically, fish recover rapidly from handling procedures. The primary factors that contribute to stress and mortality from handling are excessive doses of anesthetic, differences in water temperatures, dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Wet hands and keeping fish submersed while acquiring scientific information will minimize scale and slime removal. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen is below saturation. Also, stress can occur if there are more than a few degrees difference in water temperature between the stream/river and the holding tank. Study protocols would include only handling fish during appropriate water temperatures to avoid adding any additional stress and ensuring revival prior to release.

Fish can experience stress and injury from overcrowding in traps if the traps are not emptied on a regular basis. Debris buildup at traps can also cause injuries and mortalities if the traps are not monitored and cleared on a regular basis. Traps are proposed to be checked each morning or more frequently as necessitated by increased water flows or debris movement. Traps would not be fished during time periods when they cannot be adequately checked and maintained. Checking traps during the morning would ensure handling fish during the coolest water temperatures to reduce stress and potential mortality.

Fish that are transferred to holding tanks could experience trauma if care is not taken in the transfer process. Fish will be transferred from the traps to recovery tanks by the use of dip nets or sanctuary nets. The use of nets avoids human handling and reduces the potential for descaling or other netting injuries and potential post-handling mortality. All researchers that propose to handle and transfer fish will be required to use sanctuary nets that hold water during transfer whenever necessary to prevent the added stress of an out-of-water transfer.

Tagging/Marking

The use of PIT tags, coded-wire tags, fin clips, and radio tags are common to many scientific research efforts involving ESA-listed anadromous fish species. All tagging and marking procedures have an inherent potential to stress, injure, or even kill the test fish.

A PIT tag is an electronic device that relays signals to a radio receiver. It allows salmonids to be identified whenever they pass a location containing such a receiver (e.g., any of several dams) without researchers having to handle the fish again. The tag is inserted into the body cavity of the fish just in front of the pelvic girdle. The tagging procedure requires that the fish be captured and extensively handled, therefore, any researchers using PIT tags are required to use standardized methods and techniques to ensure that the operation takes place in the safest possible manner. In general, tagging operations take place where there is cold water, a carefully controlled environment for administering anesthesia, sanitary conditions, quality control checking, and a carefully regulated holding environment where the fish are allowed to recover.

PIT tags have very little effect on growth, mortality, or behavior. The few reported studies of PIT tags have shown no effect on growth or survival (Prentice *et al.* 1987; Jenkins and Smith 1990; Prentice *et al.* 1990). For example, in a study between the tailraces of Lower Granite and McNary Dams (225 km), Hockersmith *et al.* (2000) concluded that the performance of yearling chinook salmon was not adversely affected by gastrically- or surgically-implanted sham radio tags or PIT tags. Additional studies have shown that growth rates among PIT-tagged Snake River fall chinook salmon juveniles in 1992 (Rondorf and Miller 1994) were similar to growth rates for salmon that were not tagged (Conner *et al.* 2001). Prentice and Park (1984) also found that PIT-tagging did not substantially affect survival in juvenile salmonids.

The use of one needle to tag multiple fish has the potential to transmit diseases to the fish that are tagged. To reduce potential risks to ESA-listed fish, all Permit Holders will be required to use state-of-the-art handling and tagging techniques including the use of a sterilized needle for each individual injection to minimize the lateral transfer of pathogens.

Coded-wire tags (CWTs) are made of magnetized, stainless-steel wire. They bear distinctive notches that can be coded for such data as species, brood year, hatchery of origin, and so forth (Nielson 1992). The tags are intended to remain within the animal indefinitely, consequently making them ideal for making long-term, population-level assessments of Pacific Northwest salmon. The tag is injected into the nasal cartilage of a salmon and therefore causes little direct tissue damage (Bergman *et al.* 1968; Bordner *et al.* 1990). The conditions under which CWTs may be inserted are similar to those required for applying PIT tags. A major advantage to using CWTs is the fact that they have a negligible effect on the biological condition or response of tagged salmon; however, if the tag is placed too deeply in the snout of a fish, it may kill the fish, reduce its growth, or damage olfactory tissue (Fletcher *et al.* 1987; Peltz and Miller 1990). This latter effect can create problems for species like salmon because they use olfactory clues to guide their spawning migrations (Morrison and Zajac 1987).

In order for researchers to be able to determine later (after the initial tagging) which fish possess CWTs, it is necessary to mark the fish externally—usually by clipping the adipose fin—when the CWT is implanted (see text below for information on fin clipping). One major disadvantage to recovering data from CWTs is that the fish must be killed in order for the tag to be removed. However, this is not a significant problem because researchers generally recover CWTs from salmon that have been taken during the course of commercial and recreational harvest (and are therefore already dead).

The other primary method for tagging fish is to implant them with radio tags. There are two main ways to accomplish this and they differ in both their characteristics and consequences. First, a tag can be inserted into a fish's stomach by pushing it past the esophagus with a plunger. Stomach insertion does not cause a wound and does not interfere with swimming. This technique is benign when salmon are in the portion of their spawning migrations during which they do not feed (Nielson 1992). In addition, for short-term studies, stomach tags allow faster post-tagging recovery and interfere less with normal behavior than do tags attached in other ways.

The second method for implanting radio tags is to place them within the body cavities of (usually juvenile) salmonids. These tags do not interfere with feeding or movement. However, the tagging procedure is difficult, requiring considerable experience and care (Nielson 1992). Because the tag is placed within the body cavity, it is possible to injure a fish's internal organs. Infections of the sutured incision and the body cavity itself are also possible, especially if the tag and incision are not treated with antibiotics (Chisholm and Hubert 1985; Mellas and Haynes 1985). Fish with internal radio tags often die at higher rates than fish tagged by other means because radio tagging is a complicated and stressful process. Mortality is both acute (occurring during or soon after tagging) and delayed (occurring long after the fish have been released into the environment). Acute mortality is caused by trauma induced during capture, tagging, and release. It can be reduced by handling fish as gently as possible. Delayed mortality occurs if the tag or the tagging procedure harms the animal in direct or subtle ways. Tags may cause wounds that do not heal properly, may make swimming more difficult, or may make tagged animals more vulnerable to predation (Howe and Hoyt 1982; Matthews and Reavis 1990; Moring 1990). Tagging may also reduce fish growth by increasing the energetic costs of swimming and maintaining balance. As with the other forms of tagging and marking, researchers will keep the harm caused by radio tagging to a minimum by following the permit conditions described in the *Description of the Proposed Actions* section above, as well as any other permit-specific requirements.

Fin clipping is the process of removing part or all of one or more fins to alter a fish's appearance and thus make it identifiable. When entire fins are removed, it is expected that they will never grow back. Alternatively, a permanent mark can be made when only a part of the fin is removed or the end of a fin or a few fin rays are clipped. Although researchers have used all fins for marking at one time or another, the current preference is to clip the adipose, pelvic, or pectoral fins. Marks can also be made by punching holes or cutting notches in fins, severing individual fin rays (Welch and Mills 1981), or removing single prominent fin rays (Kohlhorst 1979). Many studies have examined the effects of fin clips on fish growth, survival, and behavior. The results of these studies are somewhat variable; however, it can be said that fin clips do not generally alter fish growth. Studies comparing the growth of clipped and unclipped fish generally have shown no differences between them (e.g., Brynildson and Brynildson 1967). Moreover, wounds caused by fin clipping usually heal quickly—especially those caused by partial clips.

Mortality among fin-clipped fish is also variable. Some immediate mortality may occur during the marking process, especially if fish have been handled extensively for other purposes (e.g., stomach sampling). Delayed mortality depends, at least in part, on fish size; small fishes have often been found to be susceptible to it and Coble (1967) suggested that fish shorter than 90 mm are at particular risk. The degree of mortality among individual fishes also depends on which fin is clipped. Studies show that adipose- and pelvic-fin-clipped coho salmon fingerlings have a 100 percent recovery rate (Stolte 1973). Recovery rates for steelhead were 60 percent when the adipose fin was clipped and 52 percent when the pelvic fin was clipped and dropped markedly when the pectoral, dorsal, and anal fins were clipped (Nicola and Cordone 1973). Clipping the adipose and pelvic fins probably kills fewer fish because these fins are not as important as other fins for movement or balance (McNeil and Crossman 1979). Mortality is generally higher when the major median and pectoral fins are clipped. Mears and Hatch (1976) showed that clipping more than one fin may increase delayed mortality, but other studies have been less conclusive. Regardless, any time researchers clip or remove fins, it is necessary that the fish be handled. Therefore, the same safe and sanitary conditions required for tagging operations also apply to clipping activities.

All tagging and handling procedures require anesthetics to calm the fish subjected to handling, especially if the fish are to be handled out-of-water. Because temperature, turbidity, fish condition, and other factors can alter a fish's reaction to an anesthetic, the concentration of an anesthetic will be adjusted for the ambient environmental conditions based on the manufacturers specifications to achieve proper sedation and minimize the risk of harming fish. Dosages will also vary by body size but would be kept at minimum levels. After the collection of biological data, captured fish will be allowed to fully recover before being released back into the stream and will be released only in slow water areas.

Electrofishing

The effects of electrofishing on ESA-listed anadromous salmon and steelhead within the action areas would be limited to the direct and indirect effects of exposure to an electric field, capture by netting, holding captured fish in aerated tanks, and the effects of handling associated with transferring the fish back to the river. It has long been recognized that overexposure of fish to a strong electric field can cause injury and death. The amount of unintentional mortality attributable to electrofishing may vary widely depending on the equipment used, the settings on the equipment, and the expertise and experience of the technician. The effects of electrofishing on adults can be severe. Spinal injuries in adult salmonids from forced muscle contraction have been documented. Sharber and Carothers (1988) reported that electrofishing caused a 50 percent mortality level in adult rainbow trout. Habera *et al*. (1996) reported overall mortality rates of 20 percent for rainbow trout less than 100 mm in length and 6 percent for those over 100 mm using a three pass depletion method. Habera *et al*. also reported an overall injury rate of 6 percent. The long-term effects on both juvenile and adult salmon and steelhead are not well understood, but it is assumed that most impacts from electrofishing occur at the time of sampling.

Most of the studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey *et al.* 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury is substantially lower than in large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (e.g., Hollender and Carline 1994, Dalbey *et al.* 1996, Thompson *et al.* 1997). The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988, McMichael 1993, Dalbey *et al.* 1996, Dwyer and White 1997). Continuous direct current (DC) or low-frequency (≤30 Hz) pulsed DC have been recommended for electrofishing (Fredenberg 1992, Snyder 1992, 1995, Dalbey *et al.* 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Fredenberg 1992, Taube 1992, McMichael 1993, Sharber *et al.* 1994, Dalbey *et al.* 1996). Only a few recent studies have examined the long-term effects of electrofishing on survival and growth of salmonids (Ainslie *et al.* 1998, Dalbey *et al.* 1996, Taube 1992). These studies indicate that although relatively large percentages of the fish suffered spinal injury, long-term mortality was very low. However, severely injured fish grew at slower rates or showed no growth compared to control or minimally damaged fish (Dalbey *et al.* 1996).

The potential for unexpected injuries or mortalities to ESA-listed fish as a result of the use of electrofishing will be mitigated in a number of ways. NOAA Fisheries' electrofishing guidelines (NMFS 2000c) will be followed. These guidelines include training field crews in observing animals for signs of stress and how to adjust electrofishers to minimize stress. Electrofishing is used only when other survey methods are not feasible. All areas for stream and special needs surveys are visually searched for fish prior to the application of an electrical current. Electrofishing is not done in the vicinity of redds or where fish are visually observed. All people operating electroshocking equipment are trained by qualified personnel to be familiar with equipment handling, settings, care, and safety. Operators work in pairs to increase visual detection of fish and fish identification with minimal or no netting. Working in pairs also allows the netter to intercept and net fish before they are attracted to water with higher electrical fields. Only DC units will be used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate will be kept at minimal levels. At the start of every electrofishing session, water conductivity will be tested, and settings will be set at minimum rates. Settings will be kept below levels which cause immobilization. Due to the low settings used, shocked fish are normally instantaneously revived. Fish requiring reviving will receive immediate, adequate care.

The preceding discussion focused on the effects of using a backpack unit for electrofishing and the ways those effects will be mitigated. It should be noted, however, that in larger streams and rivers, electrofishing units are sometimes mounted on boats. These units often use more current than backpack electrofishing equipment because they need to cover larger (and deeper) areas and, as a result, can have a greater impact on fish. In addition, the environmental conditions in larger, more turbid streams can limit the researchers' ability to minimize impacts on fish. For example, in areas of lower visibility it is difficult for researchers to detect the presence of adults and thereby take steps to avoid them. Because of its greater potential to harm fish, and because NOAA Fisheries has not published appropriate guidelines, boat electrofishing has not been given a general authorization under NOAA Fisheries' recent ESA section 4(d) rules. However, it is expected that guidelines for safe boat electrofishing will be in place in the near future. All researchers intending to use boat electrofishing will use all the means at their disposal to ensure that a minimum number of fish are harmed (these means will include a number of long-established protocols that will eventually be incorporated int NOAA Fisheries' guidelines).

<u>Sacrifice</u>
In some instances, it is necessary to kill a captured fish in order to gather whatever data a study is designed to produce. In such cases, the sacrificed fish, if juveniles, are forever removed from the ESU's gene pool; if the fish are adults, the effect depends upon whether they are killed before or after they have a chance to spawn. If they are killed after they spawn, there is very little overall effect. Essentially, it amounts to removing the nutrients their bodies would have provided to the spawning grounds. If they are killed before they spawn, not only are they removed from the ESU, but so are all their potential progeny. Thus, killing pre-spawning adults has the greatest potential to affect the ESU and, because of this, NOAA Fisheries rarely allows it

to happen. And, in almost every instance where it is allowed, the adults are stripped of sperm and eggs so their progeny can be raised in a controlled environment such as a hatchery—thereby greatly decreasing the potential harm posed by sacrificing the adults. Clearly, there is no way to mitigate the effects of outrightly sacrificing a fish.

Permit-Specific Effects

Modifications

Permit 1291-Modification 1

Modification 1 to Permit 1291 would authorize USGS to increase the number of juvenile, endangered, SnR sockeye salmon taken during scientific research conducted at John Day and Bonneville Dams on the lower Columbia River. The researchers propose to capture juvenile sockeye salmon, sample them for biological information, and release them. The annual take with the potential to result in mortalities and estimated maximum lethal takes are summarized below:

SnR Sockeye Salmon

Type of Take	SnR Sockeye Salmon Juveniles	Totals for Species
Capture, Handle, Release	170	170
Total Non-Lethal Take	**170**	**170**
Indirect Mortality	5	5
Total Lethal Take	**5**	**5**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, endangered, SnR sockeye salmon expected to emigrate from the Snake River Basin is 59,591. The number to reach John Day Dam in 2002 (under the full transportation with spill scenario) will be 1,118. The number to reach Bonneville Dam in 2002 (under the full transportation with spill scenario) will be 1,321. Five indirect mortalities of juvenile, endangered, SnR sockeye salmon are expected. If the estimated outmigration of juvenile, endangered, SnR sockeye salmon from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual non-lethal take of up to 170, and up to five lethal juvenile, endangered, SnR sockeye salmon as a result of USGS's research activities will not result in a substantial impact on the Snake River sockeye salmon ESU.

Permit 1322–Modification 1

Modification 1 to Permit 1322 would authorize the NWFSC to increase the number of salmonids they annually take in the Lower Columbia River estuary. The NWFSC proposes to beach seine near the Astoria Bridge and place trapnets in Cathlamet Bay. In addition to their current level of take, NWFSC proposes to capture (using beach seines and trap nets), anesthetize, scan for tags, measure, weigh, and release, 23 naturally produced SnR Fall chinook salmon. The NWFSC also wants to sacrifice an additional four juvenile, artificially propagated, SnR S/S chinook salmon for stomach content, scale, and otolith analyses.

SnR Spring/Summer Chinook Salmon

Type of Take	Artificially-Propagated SnR Spring/Summer Chinook Salmon Juveniles	Naturally-Produced SnR Spring/Summer Chinook Salmon Juveniles	Totals for Species
Capture, Handle, Release	16	14	30
Total Non-Lethal Take	**16**	**14**	**30**
Direct Mortality	4	0	4
Indirect Mortality	0	0	0
Total Lethal Take	**4**	**0**	**4**

The research would occur in the Columbia River estuary. According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, artificially produced, SnR spring/summer chinook salmon expected to emigrate from the Snake River Basin and reach Tongue Point (in the Columbia River estuary) in 2002 will be 847,302; the total number of juvenile, threatened, naturally produced, SnR spring/summer chinook salmon expected to emigrate from the Snake River Basin and reach Tongue Point in 2002 will be 1,057,510. If the estimated outmigration of juvenile, threatened, SnR spring/summer chinook salmon from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual lethal take of up to four juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon as a result of NWFSC's research will not have a substantial impact on the SnR spring/summer chinook salmon ESU.

SnR Fall Chinook Salmon

Type of Take	SnR Fall Chinook Salmon Juveniles	Totals for Species
Capture, Handle, Release	23	23
Total Non-Lethal Take	**23**	**23**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR fall chinook salmon expected to emigrate from the Snake River Basin and reach Tongue Point (in the Columbia River estuary) in 2002 will be 1,591,568. If the estimated outmigration of juvenile, threatened, SnR fall chinook salmon from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that handling 23 juvenile, threatened, SnR fall chinook salmon will not have a substantial impact on the SnR fall chinook salmon ESU.

NWFSC proposes to use the following measures to minimize and mitigate take: All possible steps will be taken to remove fish from the seines and nets as quickly and gently as possible. Fish are immediately placed into estuarine water with aeration. To minimize the stress to all caught fish, the cod end of the beach seine and trapnet will never be completely out of the water. Dip nets with reservoir bags will be used to dip fish out of the seine to allow fish to remain in estuarine water when handled. If catches appear to be larger than anticipated, the duration and size of the hauls can be controlled to reduce catch volume (NWFSC 2001b). NOAA Fisheries considers these to be adequate measures to minimize the impacts to the ESA-listed fish.

New Permits

Permit 1362

Permit 1362 would authorize the ICFWRU to annually take adult, threatened, artificially-propagated, SnR spring/summer chinook salmon while conducting scientific research at the Bonneville Dam on the lower Columbia River. The collection would take place at the Adult Fish Facility (AFF) located near the Washington-shore fish ladder. The fish will be diverted into an anesthetic tank (MS-222 @ 100 mg/L, or clove oil @ 0.026 ml/L dissolved in water and absorbed across the gills) via electronically controlled guide gates. Only those fish that received PIT tags as juveniles at McCall Hatchery will be selected. Once the selected fish are anesthetized they will be weighed and measured, sacrificed by applying a lethal dose of anesthesia (MS-222) and tissue samples will be extracted and preserved on dry ice for shipping to the lab for analysis. The maximum lethal takes are enumerated below:

SnR Spring/Summer Chinook Salmon

Type of Take	SnR Spring/Summer Chinook Salmon Adults	Totals for Species
Lethal Take	9	9
Total Lethal Take	**9**	**9**

These fish are likely to have originated from the Imnaha River basin, which is projected to have and adult run size of approximately 3,600 adipose-clipped adults this year (ICFWRU, 2002). NOAA Fisheries believes that the annual loss of up to nine adult, threatened, artificially-propagated, SnR spring/summer chinook salmon will not result in a substantial impact on the SnR spring/summer chinook salmon ESU.

Permit 1363

Permit 1363 would authorize the FPC to tag a number of listed fish in addition to those already authorized under Permit #1193. The researchers would tag juvenile, threatened, naturally-produced SnR spring/summer chinook salmon, and juvenile, threatened, SnR steelhead at sites on the Salmon, Snake, Clearwater, and Grande Ronde Rivers. The juvenile salmon would be captured, anesthetized (MS-222 @ 50 g/l), injected with a PIT tag, and released. The maximum annual takes with the potential to result in mortalities and estimated maximum lethal takes are enumerated below:

SnR Spring/Summer Chinook Salmon

Type of Take	Naturally-Produced SnR Spring/Summer Chinook Salmon Juveniles	Totals for Species
Capture, Handle/Tag, Release	8,350	8,350
Total Non-Lethal Take	**8,350**	**8,350**
Indirect Mortality	167	167
Total Lethal Take	**167**	**167**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 504,462; the total number of juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 371,726. A maximum of 2 percent of the ESA-listed chinook salmon juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, SnR spring/summer chinook salmon from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to 167 juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon as a result of FPC's research will not result in a substantial impact to the SnR spring/summer chinook salmon ESU.

SnR Steelhead

Type of Take	SnR Steelhead Juveniles	Totals for Species
Capture, Handle/Tag, Release	5,000	5,000
Total Non-Lethal Take	**5,000**	**5,000**
Indirect Mortality	100	100
Total Lethal Take	**100**	**100**

The annual non-lethal and lethal takes of juvenile, threatened, SnR steelhead associated with FPC's research would occur at sites on the Salmon, Snake, Clearwater, and Grande Ronde Rivers. According to the juvenile steelhead outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR steelhead expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 (under the full transportation with spill scenario) will be 484,340. A maximum of 2 percent of the ESA-listed steelhead juveniles handled may be indirectly killed.

If the estimated outmigration of juvenile, threatened, SnR steelhead from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to 100 juvenile, threatened, SnR steelhead as a result of FPC 's research will not result in a substantial impact on the SnR steelhead ESU.

Permit 1364
Proposed Permit 1364 would authorize the USFWS annual takes of juvenile, threatened, SnR fall chinook salmon and juvenile, threatened, SnR steelhead associated with a continuing project designed to evaluate the Dworshak National Fish Hatchery steelhead program in Idaho and its impacts on ESA-listed salmon and steelhead in the vicinity of the hatchery. The annual non-lethal and lethal take associated with USFWS's research would occur in the Clearwater River Basin primarily in the vicinity of and downstream of hatchery release sites ESA-listed juvenile salmon and steelhead are proposed to be observed/harassed during snorkel surveys or captured using boat or backpack electrofishing, sampled for biological information and tissue samples, and released. The maximum annual takes with the potential to result in mortalities and estimated maximum lethal takes are enumerated below:

SnR Fall Chinook Salmon

Type of Take	SnR Fall Chinook Salmon Juveniles	Totals for Species
Capture, Handle, Release	240	240
Total Non-Lethal Take	**240**	**240**
Indirect Mortality	5	5
Total Lethal Take	**5**	**5**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR fall chinook salmon expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 (under the full transportation with spill scenario) will be 1,533,715. A maximum of 2 percent of the ESA-listed chinook salmon juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, SnR fall chinook salmon from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to five juvenile, threatened, SnR fall chinook salmon as a result of USFWS's research will not result in a substantial impact to the SnR fall chinook salmon ESU.

SnR Steelhead

Type of Take	SnR Steelhead Juveniles	Totals for Species
Capture, Handle, Release	800	800
Total Non-Lethal Take	**800**	**800**

Indirect Mortality	16	16
Total Lethal Take	**16**	**16**

According to the juvenile steelhead outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR steelhead expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 (under the full transportation with spill scenario) will be 484,340. A maximum of 2 percent of the ESA-listed steelhead juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, SnR steelhead from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to 16 juvenile, threatened, SnR steelhead as a result of the USFWS's research will not result in a substantial impact on the SnR steelhead ESU.

Permit 1366

Permit 1366 would authorize the OCFWRU to take juvenile, endangered, SnR sockeye salmon; juvenile, threatened, naturally-produced and artificially-propagated, SnR spring/summer chinook salmon; juvenile, threatened, SnR fall chinook salmon and juvenile, threatened, SnR steelhead while conducting research at Lower Granite Dam on the lower Snake River and McNary and Bonneville Dams on the lower Columbia River. ESA-listed juvenile fish would be captured using lift nets or dipnets at the dams (or acquired from Smolt Monitoring Program or NOAA Fisheries personnel at Bonneville Dam), sampled for biological information or tagged with radiotransmitters, and released. Up to 3 percent of the ESA-listed juvenile fish handled each year may be indirectly killed. In addition, the OCFWRU intends to lethally take ESA-listed juvenile fish. The annual take associated with the permit is summarized below:

SnR Sockeye Salmon

Type of Take	SnR Sockeye Salmon Juveniles	Totals for Species
Capture, Handle, Release	9	9
Total Non-Lethal Take	**9**	**9**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, endangered, SnR sockeye salmon expected to emigrate from the Snake River Basin is 59,591. The number to reach Lower Granite Dam in 2002 (under the full transportation with spill scenario) will be 18,473, the number to reach McNary Dam is 2,839, and the number to reach Bonneville is 1,321.

According to IDFG (2001), 23,886 SnR sockeye salmon pre-smolts produced from IDFG's captive broodstock program were released in Redfish Lake, 12,955 SnR sockeye salmon pre-smolts were released in Alturas Lake, and 3,430 SnR sockeye salmon pre-smolts were released in Pettit lake in October 1999. If the 1999 stocking levels of sockeye salmon pre-smolts from IDFG's captive broodstock program are assumed to be typical for future years, and if the estimated outmigration of juvenile, endangered, SnR sockeye salmon from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual take of up to nine juvenile, endangered, SnR sockeye salmon associated with the OCFWRU's research will not result in a substantial impact to the SnR sockeye salmon ESU.

SnR Spring/Summer Chinook Salmon

Type of Take	Artificially-Propagated SnR Spring/Summer Chinook Salmon Juveniles	Naturally-Produced SnR Spring/Summer Chinook Salmon Juveniles	Totals for Species
Capture, Handle, Release	310	0	310
Total Non-Lethal Take	**310**	**0**	**310**
Direct Mortality	80	106	186
Indirect Mortality	9	0	9
Total Lethal Take	**89**	**106**	**194**

The number of juvenile, threatened, naturally-produced SnR spring/summer chinook salmon estimated to reach Lower Granite Dam in 2002 (under the full transportation with spill scenario) will be 504,462, the number to reach McNary Dam is 71,445, and the number to reach Bonneville is 175,253. The number of juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon estimated to reach Lower Granite Dam in 2002 (under the full transportation with spill scenario) will be 371,726, the number to reach McNary Dam is 66,246, and the number to reach Bonneville is 16,242. A maximum of 3 percent of the ESA-listed chinook salmon juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, naturally-produced and artificially-propagated, SnR spring/summer chinook salmon in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to 106 juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon and up to 89 juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon will not have a substantial impact on those populations.

SnR Fall Chinook Salmon

Type of Take	SnR Fall Chinook Salmon Juveniles	Totals for Species
Capture, Handle, Release	267	267
Capture, Tag/Mark, Release	44	44
Total Non-Lethal Take	**311**	**311**
Direct Mortality	186	186

Indirect Mortality	9	9
Total Lethal Take	**195**	**195**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR fall chinook salmon expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 1,533,715, to reach McNary Dam is 57,995, and Bonneville Dam is 6,572. A maximum of 3 percent of the ESA-listed chinook salmon juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, SnR fall chinook salmon from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to 195 juvenile, threatened, SnR fall chinook salmon as a result of OCFWRU's research activities will not result in substantial impacts on those populations.

SnR Steelhead

Type of Take	SnR Steelhead Juveniles	Totals for Species
Capture, Handle, Release	682	682
Capture, Tag/Mark, Release	48	48
Total Non-Lethal Take	**730**	**730**
Direct Mortality	37	37
Indirect Mortality	22	22
Total Lethal Take	**59**	**59**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR steelhead expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 484,340, to reach McNary Dam is 20,827, and Bonneville Dam is 17,577. A maximum of 3 percent of the ESA-listed steelhead juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, SnR steelhead from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to 59 juvenile, threatened, SnR steelhead as a result of OCFWRU's research activities will not result in substantial impacts on those populations.

Permit 1370

Utah State University (USU) requests a 1–year permit for take of juvenile, threatened, naturally-produced and artificially-propagated, SnR spring/summer chinook salmon, and adult and juvenile, threatened, SnR steelhead associated with a research project proposed to occur in the Imnaha River in Idaho. The study will use electrofishing for comprehensive bull trout density and population assessment and monitoring. NOAA Fisheries expects that this project is likely to continue for several years, and hence has analyzed the takes in the context of a 5-year permit.

SnR Spring/Summer Chinook Salmon

Type of Take	Artificially-Propagated SnR Spring/Summer Chinook Salmon Juveniles	Naturally-Produced SnR Spring/Summer Chinook Salmon Juveniles	Totals for Species
Capture, Handle, Release	150	1300	1450
Total Non-Lethal Take	**150**	**1300**	**1450**
Indirect Mortality	3	26	29
Total Lethal Take	**3**	**26**	**29**

The annual non-lethal and lethal takes of juvenile, threatened, artificially-propagated and naturally-produced, SnR spring/summer chinook salmon, and SnR steelhead associated with the study occur in the Imnaha River system in Idaho. Based on 2000's research efforts (adult escapement, redd counts, fecundity, survival information), the total amount of juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon estimated to emigrate from the Salmon River Basin in 2001 is 265,822 (unpublished data, IDFG). A maximum of 2 percent of the ESA-listed, naturally-produced, SnR spring/summer chinook salmon and SnR steelhead juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon in 2002 is assumed to be typical in future years, NOAA Fisheries does not believe that the annual loss of up to 26 juvenile, threatened, naturally-produced, and 3 juvenile, threatened, artificially-propagated SnR spring/summer chinook salmon as a result of USU's research activities will result in substantial impacts on those populations.

SnR Steelhead

Type of Take	SnR Steelhead Adults	Totals for Species
Capture, Handle, Release	6	6
Total Non-Lethal Take	**6**	**6**

Type of Take	SnR Steelhead Juveniles	Totals for Species
Capture, Handle, Release	600	600
Total Non-Lethal Take	**600**	**600**
Indirect Mortality	12	12

Total Lethal Take	**12**	**12**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR steelhead expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 484,340. A maximum of 2 percent of the ESA-listed steelhead juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, SnR steelhead from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to 12 juvenile, threatened, SnR steelhead will not result in substantial impacts on those populations.

Permit 1386
The Washington Department of Ecology in Olympia, WA (WDOE) requests a 5-year permit for annual takes of threatened, adult and juvenile, naturally-produced and artificially-propagated, SnR spring/summer chinook salmon; threatened, adult and juvenile, SnR fall chinook salmon; and threatened, adult and juvenile, SnR steelhead, in the state of Washington associated with a research project proposed to occur in the Snake River. The objective of the research is to investigate the occurrence and monitor the concentrations of toxic contaminants in edible fish tissue and the freshwater environments of the state as part of the Washington State Toxics Monitoring Program. Adults and juveniles from the Snake River in Washington state are proposed to be captured annually (using nets, seines, or electrofishing), sampled for biological information, and released. Up to 2 percent of the ESA-listed juvenile fish proposed to be handled by WDOE researchers may be killed unintentionally.

SnR Fall Chinook

Type of Take	SnR Fall Chinook Adults	SnR Fall Chinook Juveniles	Totals for Species
Capture, Handle, Release	6	30	36
Total Non-Lethal Take	**6**	**30**	**36**
Indirect Mortality	0	1	1
Total Lethal Take	**0**	**1**	**1**

The annual non-lethal and lethal takes of juvenile, threatened, SnR fall chinook salmon associated with WDOE's research activities occur on the lower Snake River in Washington State. According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR fall chinook salmon expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 1,533,715. A maximum of 2 percent of the ESA-listed chinook salmon juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, SnR fall chinook salmon from the Snake River Basin is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to one juvenile, threatened, SnR fall chinook salmon as a result of WDOE's research activities will not result in substantial impacts on those populations.

SnR Spring/Summer Chinook Salmon

Type of Take	SnR Spring/Summer Chinook Salmon Adults	Artificially-Propagated SnR Spring/Summer Chinook Salmon Juveniles	Naturally-Produced SnR Spring/Summer Chinook Salmon Juveniles	Totals for Species
Capture, Handle, Release	12	30	30	72
Total Non-Lethal Take	**12**	**30**	**30**	**72**
Indirect Mortality	0	1	1	2
Total Lethal Take	**0**	**1**	**1**	**2**

The number of juvenile, threatened, naturally-produced SnR spring/summer chinook salmon estimated to reach Lower Granite Dam in 2002 (under the full transportation with spill scenario) will be 504,462. The number of juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon estimated to reach Lower Granite Dam in 2002 (under the full transportation with spill scenario) will be 371,726. A maximum of 2 percent of the ESA-listed chinook salmon juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, naturally-produced and artificially-propagated, SnR spring/summer chinook salmon in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to one juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon and the annual loss of up to one juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon as a result of the WDOE's research activities will not result in substantial impacts on those populations.

SnR Steelhead

Type of Take	SnR Steelhead Adults	Totals for Species
Capture, Handle, Release	6	6
Total Non-Lethal Take	**6**	**6**

Type of Take	SnR Steelhead Juveniles	Totals for Species
Capture, Handle, Release	30	30
Total Non-Lethal Take	**30**	**30**

Indirect Mortality	1	1
Total Lethal Take	**1**	**1**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR steelhead expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 484,340. A maximum of 2 percent of the ESA-listed steelhead juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, SnR steelhead from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to one juvenile, threatened, SnR steelhead will not result in substantial impacts on those populations.

Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions not involving Federal activities that are reasonably certain to occur within the action area subject to this consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

State, tribal and local government actions will likely to be in the form of legislation, administrative rules or policy initiatives. Government and private actions may encompass changes in land and water uses—including ownership and intensity—any of which could impact listed species or their habitat. Government actions are subject to political, legislative, and fiscal uncertainties. These realities, added to the geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and speculative. For more information on the various efforts being made at the local, tribal, state, and national levels to conserve SnR chinook salmon and steelhead, please see and NOAA Fisheries (2002a).

Non-Federal actions are likely to continue affecting listed species. The cumulative effects in the action area are difficult to analyze considering the large geographic scope of this opinion, the different resource authorities in the action area, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although state, tribal and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NOAA Fisheries can consider them "reasonably foreseeable" in its analysis of cumulative effects.

Integration and Synthesis of Effect

The cumulative take analysis for the proposed actions that occur in tributary areas assumes that the effects on the ESA-listed fish are best represented by describing the effects on the specific populations. For the proposed actions that occur in the tributary areas, the relative risk to the species is determined by comparing the potential annual cumulative mortality level of each affected life stage (adults, migrating juveniles or smolts, and non-migrating juveniles) caused by the proposed actions to recent estimates of the total number of fish (for the life stage) present in each affected population, if that information is available.[3] The annual maximum mortality level of each affected life stage resulting from the proposed actions that are likely to cause mortalities (from the tables below) is then expressed as a percentage of the estimated total number of fish in each population affected by the proposed actions.

For the proposed actions that occur in the mainstem migration corridor, the relative risk to the ESA-listed species is determined by comparing the potential annual cumulative mortality level of each affected life stage (adults and migrating juveniles or smolts) caused by the proposed actions to recent estimates of the total number of fish (for that life stage) present for the ESU as a whole at a specific reference point in the river, usually at one of the hydropower dams in the vicinity of where the research activities would occur. When the juvenile fish migrate as smolts out of the tributary areas from which they originate and enter the mainstem migration corridor, they encounter a completely different set of hazards which affect their ability to survive. Also, the degree of risk to the fish changes when they begin to migrate out of the tributary areas. For example, in the mainstem migration corridor, multiple takes of individual fish (fish that are handled more than once) start to add up. Also, in the mainstem migration corridor, migrating smolts encounter variable environmental conditions such as changing temperature and salinity regimes, risks associated with passing over concrete hydropower dams (such as gas bubble trauma) and through electricity-generating turbines, and an increased exposure to predators. The annual maximum mortality level of each affected life stage resulting from the proposed actions is then expressed as a percentage of the estimated total number of fish for each ESU present at the chosen reference point in the river (see tables below).

<u>Snake River Sockeye Salmon Juveniles</u>
The following table summarizes the cumulative annual lethal and non-lethal take of juvenile, endangered, SnR sockeye salmon associated with the proposed actions. For this analysis, the table only includes takes of migrating juvenile, endangered, SnR sockeye salmon. Lethal take in the table includes proposed indirect mortalities where applicable.

SnR Sockeye Salmon Juveniles

[3] To the extent that production information at the population level is not available, the cumulative take analysis is conducted at the river system level. To the extent that production information by river system is not available, the cumulative take analysis is conducted for the ESU as a whole.

Proposed Permit Action	Non-lethal Take of SnR Sockeye Salmon Juveniles	Lethal Take of SnR Sockeye Salmon Juveniles
1291	170	5
1366	9	0
Totals	**179**	**5**

The annual non-lethal and lethal takes of migrating juvenile, endangered, SnR sockeye salmon associated with the proposed scientific research activities and salvage/rescue operations would take place at the Lower Granite Dam on the lower Snake River and McNary and Bonneville Dams on the lower Columbia River. According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, endangered, SnR sockeye salmon expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 18,473; the number to reach McNary Dam is 2,839, and the number to reach Bonneville is 1,321.

Thus the percent mortality of juvenile, endangered, SnR sockeye salmon expected to be killed by the research is 0.023 percent (5/18,473). Based on the foregoing analysis, NOAA Fisheries concludes that the annual proposed non-lethal take of up to 179 juvenile, endangered, SnR sockeye salmon, together with the annual lethal take of up to five juvenile, endangered, SnR sockeye salmon will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

Snake River Spring/Summer Chinook Salmon Adults

One of the proposed actions involving takes of adult, threatened, SnR spring/summer chinook salmon would occur in the Snake River in Washington, while one would take place at Bonneville Dam. Since there is only one permit action that involves a take of adult, threatened, SnR spring/summer chinook salmon on the mainstem Columbia River migration corridor, the individual analysis for that permit action is deemed to be sufficient and is excluded from this cumulative take analysis. The following table summarizes the cumulative annual lethal and non-lethal take of adult, threatened, SnR spring/summer chinook salmon associated with the proposed actions. Because the observe/harass take category and the handling of ESA-listed adult fish carcasses, if applicable, will not be enumerated in the proposed permits, they are not included in the table (these activities are not likely to result in any mortalities).

SnR Spring/Summer Chinook Salmon Adults

Proposed Permit Action	Non-lethal Take of SnR Spring/Summer Chinook Salmon Adults	Lethal Take of SnR Spring/Summer Chinook Salmon Adults
1362	0	9
1386	12	0
Totals	**12**	**9**

The annual non-lethal and lethal takes of adult, threatened, SnR spring/summer chinook salmon associated with the proposed scientific research activities and salvage/rescue operations would occur in the Snake River and at Bonneville Dam. According to the *U.S. v. Oregon* TAC, as many as 11,825 adult, threatened, SnR spring/summer chinook salmon escaped to Lower Granite Dam during the upstream salmonid migration in 2000 (TAC 2000). Pre-season estimates for escapement of wild SnR S/S chinook salmon to the Snake River Basin for 2002 is 29,400 (Pollard 2002).

Thus the percent mortality of adult, threatened, SnR spring/summer chinook salmon expected to be killed by the research from the ESU is 0.0003 percent (9/29,400). Based on the foregoing analysis, NOAA Fisheries concludes that the annual non-lethal take of up to 12 adult, threatened, SnR spring/summer chinook salmon, together with the annual lethal take of up to nine adult, threatened, SnR spring/summer chinook salmon will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

Snake River Spring/Summer Chinook Salmon Juveniles

The following table summarizes the cumulative annual lethal and non-lethal take of juvenile, threatened, naturally-produced and artificially-propagated, SnR spring/summer chinook salmon associated with the proposed actions.

SnR Spring/Summer Chinook Salmon Juveniles

Proposed Permit Action	Non-lethal Take of Artificially-Propagated SnR Spring/Summer Chinook Salmon Juveniles	Lethal Take of Artificially-Propagated SnR Spring/Summer Chinook Salmon Juveniles	Non-lethal Take of Naturally-Produced SnR Spring/Summer Chinook Salmon Juveniles	Lethal Take of Naturally-Produced SnR Spring/Summer Chinook Salmon Juveniles	Total Lethal Take
1322	16	4	14	0	4
1363	0	0	8,350	167	167
1366	310	89	0	106	194
1370	150	3	1300	26	29
1386	30	1	30	1	2
Totals	**506**	**97**	**9694**	**300**	**396**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 (under the full transportation with spill scenario) will be 504,462; the total number of juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 (under the full transportation/no spill scenario) will be 371,726.

Percent mortality of juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon associated with the proposed actions is 0.0006 percent (300/504,462); percent mortality of juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon associated with the proposed actions is 0.0002 percent (97/371,726). Based on the foregoing analysis, NOAA Fisheries concludes that the annual non-lethal take of up to 9,694 juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon and up to 506 juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon that is proposed to occur from the ESU's population, together with the annual lethal take of up to 300 juvenile, threatened, naturally-produced, SnR spring/summer chinook salmon and up to 97 juvenile, threatened, artificially-propagated, SnR spring/summer chinook salmon that is proposed to occur from the ESU's population, will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

<u>Snake River Fall Chinook Salmon Adults</u>
The following table summarizes the cumulative annual lethal and non-lethal take of adult, threatened, SnR fall chinook salmon. Since the observe/harass take category and the handling of ESA-listed adult fish carcasses, if applicable, will not be enumerated in the proposed permits, they are not included in the table (these activities are not likely to result in any mortalities).

SnR Fall Chinook Salmon Adults

Proposed Permit Action	Non-lethal Take of SnR Fall Chinook Salmon Adults	Lethal Take of SnR Fall Chinook Salmon Adults
1386	6	0
Totals	**6**	**0**

According to the Fish Passage Center, as many as 8,915 adult SnR fall chinook salmon returned to Lower Granite Dam on the Snake River during the upstream salmonid migration in 2001 (FPC 2002). No mortalities of adult, threatened, SnR fall chinook salmon are expected. If the adult escapement of ESA-listed SnR fall chinook salmon to the Snake River Basin in 2000 is assumed to be typical for future years, NOAA Fisheries believes that the annual non-lethal take of up to six adult, threatened, SnR fall chinook salmon from the Snake River populations as a result of the research will not result in substantial impacts on those populations. Adequate measures are in place to minimize the effects of the non-lethal take.

<u>Snake River Fall Chinook Salmon Juveniles</u>
The following table summarizes the cumulative annual lethal and non-lethal take of juvenile, threatened, SnR fall chinook salmon associated with the proposed actions.

SnR Fall Chinook Salmon Juveniles

Proposed Permit Action	Non-lethal Take of SnR Fall Chinook Salmon Juveniles	Lethal Take of SnR Fall Chinook Salmon Juveniles
1322	23	0
1364	240	5
1366	311	195
1386	30	1
Totals	**604**	**201**

According to the juvenile salmon outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR fall chinook salmon expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 1,533,715, to reach McNary Dam is 57,995, Bonneville Dam is 6,572, to reach Tongue Point (in the Columbia River estuary) in 2002 will be 1,591,568. A maximum of 2 percent of the ESA-listed chinook salmon juveniles handled may be indirectly killed. If the estimated outmigration from the Snake River Basin to Lower Granite Dam, the Columbia river estuary, Bonneville and McNary Dams in 2002 is assumed to be typical for future years, NOAA Fisheries believes that the annual loss of up to 201 juvenile, threatened, SnR fall chinook salmon will not result in substantial impacts on those populations.

Using the number of fish to reach the mouth of the Columbia River, percent mortality of juvenile, threatened, SnR fall chinook salmon associated with the actions proposed to occur from the Snake River populations is 0.0001 percent (201/1,591,568). Based on the foregoing analysis, NOAA Fisheries concludes that the annual non-lethal take of up to 604 juvenile, threatened, SnR fall chinook salmon that would occur will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

<u>Snake River Steelhead Adults</u>
The following table summarizes the cumulative annual non-lethal take that has the potential to result in lethal take and the cumulative annual lethal take of adult, threatened, SnR steelhead associated with the actions proposed to occur within the species' ESU.

SnR Steelhead Adults

Proposed Permit Action	Non-lethal Take of SnR Steelhead Adults	Lethal Take of SnR Steelhead Adults
1370	6	0
1386	6	0
Totals	**12**	**0**

No mortalities of adult, threatened, SnR steelhead are expected. As many as 47,711 adult, threatened, SnR steelhead escaped to Lower Granite Dam during the upstream steelhead migration in 2001, and the average from the previous ten years was 74,341 (FPC, 2002). If the adult escapement of ESA-listed steelhead to Lower Granite Dam in previous years is assumed to be typical for future years, NOAA Fisheries does not believe that the non-lethal take associated with the proposed actions will appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

<u>Snake River Steelhead Juveniles</u>
The following table summarizes the cumulative annual lethal and non-lethal take of juvenile, threatened, SnR steelhead associated with the proposed actions. Since the observe/harass take category and the handling of ESA-listed juvenile steelhead carcasses, if applicable, will not be enumerated in the proposed permits, they are not included in the table (these activities are not likely to result in any mortalities of ESA-listed steelhead). Lethal take in the table includes both proposed direct mortalities and proposed indirect mortalities where applicable.

SnR Steelhead Juveniles

Proposed Permit Action	Non-lethal Take of SnR Steelhead Juveniles	Lethal Take of SnR Steelhead Juveniles
1363	5,000	100
1364	800	16
1366	730	59
1370	600	12
1386	30	1
Totals	**7160**	**188**

According to the juvenile steelhead outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR steelhead expected to emigrate from the Snake River Basin and reach Lower Granite Dam in 2002 will be 484,340. In addition, according to the juvenile steelhead outmigration estimates produced by NOAA Fisheries' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of juvenile, threatened, SnR steelhead expected to emigrate from the Snake and Tucannon River Basins and reach Lower Monumental Dam (the first Snake River dam downstream from the confluence of the Snake and Tucannon Rivers) under the full transportation with spill scenario in 2002 will be 126,662 (this number is considerably less than the number of juvenile steelhead that are expected to reach Lower Granite Dam because the majority of the SnR steelhead juveniles that reach Lower Granite Dam under the full transportationn with spill scenario will be removed from the river at the dam and transported downriver in barges). A maximum of 2 percent of the ESA-listed steelhead juveniles handled may be indirectly killed. If the estimated outmigration of juvenile, threatened, SnR steelhead from the Snake River Basin in 2002 is assumed to be typical for future years, NOAA Fisheries does not believe that the annual loss of up to 188 juvenile, threatened, SnR steelhead from the Snake River populations will result in substantial impacts on those populations.

Percent mortality of juvenile, threatened, SnR steelhead associated with the actions proposed to occur in the Snake River Basin 0.0004 percent (188/484,340). Based on the foregoing analysis, NOAA Fisheries concludes that the annual non-lethal take of up to 7,160 juvenile, threatened, SnR steelhead, together with the annual lethal take of up to 188 juvenile, threatened, SnR steelhead will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

CONCLUSIONS

After reviewing the current status of the endangered and threatened species that are the subject of this consultation, the environmental baseline for the action area, the effects of the proposed section 10(a)(1)(A) permit actions, and cumulative effects, it is NOAA Fisheries' biological opinion that issuance of the permit actions, as proposed, and the funding of the proposed activities by Federal agencies, if applicable, are not likely to jeopardize the continued existence of endangered SnR sockeye salmon, threatened SnR spring/summer chinook salmon, threatened SnR fall chinook salmon, or threatened SnR steelhead or result in the destruction or adverse modification of the species' respective designated critical habitats.

Coordination with the National Ocean Service

None of the activities contemplated in this Biological Opinion will be conducted in or near a National Marine Sanctuary. Therefore, these activities will not have an adverse effect on any National Marine Sanctuary.

CONSERVATION RECOMMENDATIONS

Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to develop additional information, or to assist Federal agencies in complying with their obligations under section 7(a)(1) of the ESA. NOAA Fisheries believes the following conservation recommendation is consistent with these obligations, and therefore should be implemented:

> NOAA Fisheries shall monitor actual annual takes of ESA-listed fish species associated with scientific research and enhancement activities, as provided to NOAA Fisheries in annual reports or by other means, and shall adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the ESA-listed species.

REINITIATION OF CONSULTATION

Consultation must be reinitiated if: The amount or extent of cumulative annual takes specified in the permits is exceeded or is expected to be exceeded; new information reveals effects of the actions that may affect the ESA-listed species in a way not previously considered; a specific action is modified in a way that causes an effect on the ESA-listed species that was not previously considered; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) is defined in section 3 of the Magnuson-Stevens Act (MSA) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NOAA Fisheries interprets EFH to include aquatic areas and their associated physical, chemical, and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NOAA Fisheries before it authorizes, funds, or carries out any action that may adversely effect EFH. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects to EFH. Further, the action agency must provide a detailed, written response to NOAA Fisheries within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NOAA Fisheries' conservation recommendation, the agency must explain its reasons for not following the recommendations.

Thus, one of the objectives of this consultation is to determine whether the proposed actions—the issuance of scientific research and/or enhancement permits under section 10(a)(1)(A) of the ESA—are likely to adversely affect EFH. If the proposed actions are likely to adversely affect EFH, conservation recommendations will be provided.

Identification of Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the Magnuson-Stevens Act. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species, and salmon off the coasts of Washington, Oregon, and California. Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for several species of Pacific salmon (PFMC 1999). For purposes of this consultation, freshwater EFH for salmon includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to Pacific salmon, except those upstream of the impassable dams. In the future, should subsequent analyses determine the habitat above any impassable dam is necessary for salmon conservation, the PFMC will modify the identification of Pacific salmon EFH (PFMC 1999). Marine EFH for Pacific salmon in Oregon and Washington includes all estuarine, nearshore, and marine waters within the western boundary of the U.S. Exclusive Economic Zone (EEZ) 200 miles offshore.

Proposed Action and Action Area

For this EFH consultation, the proposed actions and action area are as described in detail above. The actions are the issuance of a number of scientific research and/or enhancement permits pursuant to section 10(a)(1)(A) of the ESA. The proposed action area is the Snake River Basin, including all river reaches accessible to salmon in the Snake River tributaries upstream to Hells Canyon Dam in Idaho, as well as the Columbia River migration corridor. A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts on these species' EFH from the above proposed action is based on this information.

Effects of the Proposed Action
Based on information submitted by the action agencies and permit applicants, as well as NOAA Fisheries' analysis in the ESA consultation above, NOAA Fisheries believes that the effects of the actions on EFH are likely to be within the range of effects considered in the ESA portion of this consultation.

Conclusion
Using the best scientific information available and based on its ESA consultation above, as well as the foregoing EFH sections, NOAA Fisheries has determined that the proposed actions are not likely to adversely affect EFH designated for Pacific salmon

EFH Conservation Recommendation
NOAA Fisheries has no conservation recommendations to make in this instance

Consultation Renewal
The action agencies must reinitiate EFH consultation if plans for these actions are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

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